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MATERIALS SURVEY

RUBBER

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I

Definition and Description of Rubber Types

Definition and Description of Rubber Types

A. NATURAL RUBBER

Natural rubber occurs in many different forms of plant life—trees, shrubs, vines, smaller plants, and tubers—growing in various parts of the world, but mainly in the equatorial and sub-tropical regions. Until 1900, the world's rubber came entirely from uncultivated plants, mainly from trees in tropical America and trees and vines in Africa. Castilloa trees indigenous to Central and northern South America were the leading source of rubber until about 1875, after that Hevea trees indigenous to the Amazon Valley held the lead. Llandolphia vines and Funtumia Elastica trees in Africa became important sources starting about 1880. Guayule shrubs (Mexico and Southern Texas) have been exploited for rubber since 1905. A rising price trend for rubber from 1840 to 1910 led to the commercial exploitation of all worth-while wild rubber sources. The search for rubber promoted exploration of little-known and remote tropical regions during this period. It also stimulated efforts to produce rubber from trees planted for that purpose, from 1870 onwards.

A list of the principal types and grades of wild rubber still traded are shown in table I, A(1). The general sources of each type are indicated. These rubbers are today of little importance internationally except that in a time of emergency they might again be more fully exploited as they were during World War II.

The first rubber planters experimented with many different trees, but the Hevea tree gained supremacy at an early date in the plantation industry which started in Ceylon and Malaya, and spread to what is now Indonesia, as well as British Borneo, Indochina, India, Burma, and Thailand, and more recently Liberia, other West African countries, and the Philippine Islands. A destructive leaf disease, scarcity of labor, and instability of governments in tropical American countries, were the chief barriers there to Hevea plantation developments, which are as yet of negligible importance. Today, over 95 percent of the production capacity for natural rubber is in Southeast Asia and nearby islands.

The principal grades of wild rubber which are still occasionally traded internationally include:

Table I, A(1).—WILD RUBBERS

<i>Paras:</i>	(from South America, chiefly Amazon Basin)
	Upriver fine
	Upriver fine, washed and dried
	Upriver coarse
	Upriver coarse, washed and dried
	Islands fine
	Islands fine, washed and dried
	Acre, Bolivian fine
	Acre, Bolivian fine, washed and dried
	Beni, Bolivian fine
	Madeira fine
<i>Caucho:</i>	(from Central America and northern South America)
	Upper ball
	Upper ball, washed and dried
	Lower ball
<i>Africans:</i>	(from West Coast of Africa)
	Rio Munez
	Black Kassai
	Prime Niger flake

The plantation rubber industry in the Far East quickly assumed a capitalistic form of enterprise, large companies owned by Europeans, Asiatics, and some Americans,

operating estates mostly under white management, employing chiefly Indian and Chinese labor in Malaya, Javanese in Indonesia, and local labor elsewhere. As the workers learned to plant trees, tap, and prepare rubber, a native rubber industry sprang up alongside the estate industry. Today the native industry accounts for roughly a quarter of the production in Ceylon, 45 percent in Malaya, three-fourths in Indonesia, and nearly all the Thai output. In British Borneo, Sarawak production is two-thirds native rubber, while North Borneo is mainly estate. In Indochina, where plantations became important only in the late 1920's, native participation is as yet negligible. It is noteworthy that in 1950, native rubber from Indonesia and Malaya accounted for 28 percent and 17 percent respectively of the total world production of natural rubber. The growth of the native industry since 1920 was greatly stimulated in Indonesia, Thailand and British Borneo by the price effects of the British Rubber Restriction Scheme of 1922-28 and the International Rubber Regulation Scheme of 1934-43, while the development of plantations in Liberia and the Philippines, and experimental plantations in tropical America, stem from the same effects.

The American rubber manufacturing and trading interests have been influential in the establishment of trade classifications and standards for natural rubber, of which the United States has always been the leading importing country. A list of the type descriptions of plantation Hevea rubber established by the Rubber Manufacturers Association, Inc., and endorsed by the Rubber Trade Association of New York, Inc., is attached. [I, A(2).] Since World War II, adherence to standards by Far Eastern shippers has been faulty.

The large estates produce most of the high quality Ribbed Smoked Sheets, the Latex Crepes, and all the latices shipped in liquid form—mainly concentrates. The other types and grades cover rubber mainly of native origin, much of which requires treatment (cleaning and drying in Far East remilling plants) before shipment to consuming markets. For high quality natural rubber and latex, the world is dependent on what appears to be a dwindling or at best a static estate output; for the lower grades the world is dependent on natives whose output lacks uniformity and cleanliness.

Rubber is taken from the Hevea tree in the form of a liquid, known as latex. The dry rubber content of normal latex averages approximately 3 1/2 pounds to the Imperial gallon (1.20032 US gallons). The water content of normal latex is about 65 percent. To reduce transportation costs, much of the water is removed by centrifuging and/or creaming before international shipment of the concentrates. Latex of 60 percent dry rubber content is considered the most desirable form by many consuming companies. While shipped to small consumers in drums of 25 or 50 Imperial gallons to some extent, the bulk movement is in tank steamers from producing to consuming countries, and in tank cars in the United States. In bulk shipments the loading and discharge facilities are similar to those used for handling petroleum.

The following type descriptions of hevea rubber of plantation origin have been adopted by The Rubber Manufacturers Association and endorsed by The Rubber Trade Association of New York, Inc.

Table 1, A(2).—PLANTATION RUBBER TYPES AND GRADES

Ribbed Smoked Sheets:

- No. IX—Superior Quality Ribbed Smoked Sheets, European Estates
- No. 1—Standard Quality Ribbed Smoked Sheets
- No. 2—Good Fair Average Quality Ribbed Smoked Sheets
- No. 3—Fair Average Quality Ribbed Smoked Sheets
- No. 4—Low Fair Average Quality Ribbed Smoked Sheets
- No. 5—Inferior Fair Average Quality Ribbed Smoked Sheets

Thick Latex Crepes:

- No. IX—Superior Quality Thick Pale Latex Crepe
- No. 1—Standard Quality Thick Pale Latex Crepe
- No. 2—Fair Average Quality Thick Palish Latex Crepe

Thin Latex Crepes:

- No. IX—Superior Quality Thin Pale Latex Crepe
- No. 1—Standard Quality Thin Pale Latex Crepe
- No. 2—Fair Average Quality Thin Palish Latex Crepe

Table I, A(2).—PLANTATION RUBBER TYPES AND GRADES—Continued

Brown Crepes—European Estates:

Thick Brown Crepes:¹

- No. 1X—Clean Thick Light Brown Crepe, European Estates
- No. 2X—Clean Thick Brown Crepe
- No. 3X—Brown to Dark Brown Thick Specky Crepe, European Estates

Remilled Crepes:

Thick Crepes:

- No. 1—Superior Clean Light Brown Remilled Blanket Crepe¹
- No. 2—Clean Light Brown Remilled Blanket Crepe
- No. 3—Clean Brown Remilled Blanket Crepe
- No. 4—Brown to Dark Brown Remilled Blanket Crepe

Thin Crepes:

- No. 1—Superior Clean Thin Light Brown Remilled Crepe
- No. 2—Clean Thin Light Brown Remilled Crepe
- No. 3—Clean Thin Brown Remilled Crepe
- No. 4—Thin Brown to Dark Brown Specky Remilled Crepe
- No. 5—Rolled Brown Crepe and/or Flat Bark Crepe

¹ These types are provided for by description only. No official types established.

Numerous special forms of plantation rubber have been developed by estates in recent years. Examples are sprayed rubber compressed in solid blocks, rubber powder such as "Mealorub" for roadways, sole crepes of specific thicknesses to meet demands of shoe manufacturers, and the French-initiated "technically classified" rubber which is now under test.

Guayule rubber, produced since 1905 from the shrub indigenous to Mexico, has received considerable attention because it can be grown within the United States. Except in times of rubber shortage, it has never been in strong demand. As marketed in the past, this rubber contains about 25 percent resin; deresination would increase its cost while improving its quality. It has been demonstrated that it can be grown on plantations, but not that it could ever be a commercially practicable enterprise on a large scale. For strategic reasons, the United States Government continues to provide funds for experimental work on guayule and other plants which could produce rubber within our continental limits. Now that we have synthetic rubber, the possibility that we might sometime have recourse to domestic production of natural rubber appears remote.

B. SYNTHETIC OR CHEMICAL RUBBERS

While efforts were made to produce a chemical substitute for rubber in the preceding century, and under the spur of all-time high prices for the natural product in 1909-12, success was achieved only in recent years and stemmed from strategic rather than economic considerations.

Germany, in World War I, produced a few thousand tons of so-called "methyl rubber" suitable for use in hard rubber products. Soviet Russia in the 1920's began the production of synthetic rubbers partly to reduce its dependence on imported rubber for strategic reasons and partly to save foreign exchange. In the early 1930's, Germany under Hitler devoted efforts to the development of synthetic rubbers in order to become independent of imports in the war which was even then anticipated in German high councils. In the United States, Dupont in 1931 announced Neoprene, various rubber companies had small pilot plants producing N-Type rubber at the time of the Pearl Harbor attack, and Standard Oil was producing small amounts of butyl in the laboratory. The conquest of the Far Eastern rubber-producing countries by Japan forced the United States Government into its huge program of synthetic rubber production. Note that except in the United States, the development has been entirely

under Government auspices and direction. The Canadian industry is an outgrowth of that in the United States, and is also a Government undertaking.

The synthetic rubbers produced in the United States include:

GR-S.—A general purpose rubber suitable for bulk usage in a wide range of applications to replace natural rubber. Chiefly employed in the production of tires (except the larger truck, bus, and other heavy duty tires), in camelback, rubber heels and soles, rubber tiling and flooring, mechanical rubber goods, wire insulation, etc. It is produced by the copolymerization of styrene and butadiene, originally in the proportion of roughly one to three, more recently with an average of 23 percent bound styrene. An increasing part of the production now contains but 20 percent bound styrene. GR means Government Rubber; S signifies Styrene type. A small quantity of S-Type rubber is privately produced. GR-S is produced both in the intermediate form of latex, and in dry form with numerous sub-types in active demand.

Butyl.—Produced by copolymerization at extremely low temperatures of isobutylene and isoprene, both petroleum derivatives. It is markedly superior to natural rubber in air retention, and is chiefly used in inner tubes of all kinds, where it has largely supplanted high grade natural rubber. This material is not compatible with natural rubber, from which it must be separately handled in factory operations. Inner tubes made from butyl are specially marked to facilitate segregation by scrap rubber dealers and reclaimers. Produced entirely by the Government in dry form, with several active sub-types.

Neoprene.—A special purpose rubber produced by polymerization of chloroprene, which is made from acetylene, and hydrochloric acid. The chief characteristics are high resistance to mineral oils, heat, oxidation, ozone, sunlight and burning. Used almost wholly in non-transportation applications, in the fields of electrical wire coverings, mechanical, industrial, and specialty rubber products. Produced both in latex and dry forms. Domestic production entirely by du Pont with a wide range of subtypes.

N-Type Rubbers.—These special purpose rubbers are copolymers of butadiene and acrylonitrile. They compete with Neoprene in applications where resistance to oil and gasoline is essential, particularly gasoline containing aromatic compounds. Produced entirely by private firms, both in latex and solid forms.

Other Types.—Thiokol is the trade name for a group of polysulfide rubber-like materials finding application where high resistance to oils and chemicals which attack natural rubber is desired, and where its unpleasant odor is not a factor. High-styrene butadiene copolymers find application in paints, and as resins. Silicone rubber, despite extreme high cost, possesses such high resistance to extremes of temperature, that it is finding increasing use in numerous small applications. In addition there are many plastics which are similar to rubber in physical properties and which are in increasing amounts being blended with the synthetic rubbers to improve desired properties. These plastics have also replaced many uses in which rubber was formerly required.

C. RECLAIMED RUBBER

The possibility of further utilization of rubber material obtained from factory scrap and from worn-out rubber products, as a measure of economy, engaged the attention of early manufacturers of rubber goods. Regrinding factory scrap and using it in new products has been and still is a common practice.

Reclaimed rubber as such, made from worn-out and discarded rubber products, is essentially an American contribution to rubber supply. By 1890, there were independent companies in this country producing reclaim by the acid process for sale to rubber manufacturers. With the initiation of the alkali process for destroying the textile content of scrap rubber, under the Marks patents, the industry grew rapidly, and from 1900 reclaim has been an alternative material used regularly in certain rubber products to replace new rubber, and finding larger use in a wider range of products whenever new rubber prices were unusually high or supplies scanty. It was successfully employed in combatting high prices for natural rubber in the 1925-29 period of British rubber restriction, to extend the limited supplies of new rubber in the early years of World War II before the output of synthetics reached large volume, and again in the year ended June 1951, while supplies of new rubber for use

by the American industry were insufficient to meet demand and consumption was restricted by Government regulations.

The reclaiming processes, using scrap rubber products for raw material, involve grinding the material into particles, destroying textiles by acid or alkali treatment, reducing the material to fluid condition with addition of oils in digesters, screening out metallic particles, drying and calendering the resulting reclaim, and preparing it in thick sheets or blocks for shipment. Scrap rubber free of metallic parts without textiles, and not heavily loaded with inert compounds, is most valuable, the value decreasing to the extent that these compounds are in the material. Reclaimed rubber contains much of the combined sulphur, carbon black, zinc oxide and other chemicals that were in the original products, about 50 percent of its weight, on the average, consisting of rubber hydrocarbons. Products containing natural rubber and/or GR-S are reclaimable by the same process, and while butyl is usually segregated and separately reclaimed, small amounts of butyl will not materially affect the reclaim. Butyl reclaim can be compounded only with new butyl, however.

Reclaim is regularly used in tires in the bead construction, and for competitive and economic reasons at times is used in the production of third and fourth line low-priced passenger tires, and low grade camelback. The advent of synthetic rubber has not, apparently, much affected the percentage use of reclaim in transportation rubber goods as yet.

In the field of nontransportation products, however, reclaim has definitely lost ground to the chemical rubbers and plastics. In rubber heels, flooring, mats and matting, insulated wire covering, and hoses of various kinds, where reclaim found a large use before World War II, its consumption has declined seriously in postwar years. In 1939, the ratio of reclaim to new rubber used in nontransport goods was 65.2 percent, in 1950 it was but 36.5 percent, and as already stated the consumption of reclaim in 1950 was temporarily rising because of high prices and restriction of consumption of natural rubber. A large use of reclaim continues in the manufacture of hard rubber containers for batteries.

The types of reclaim regularly quoted in current trade periodicals, are shown in table I, C(1) and the quotations (September 1951) indicate their relative values.

Table I, C(1).—TYPES OF RECLAIM, SEPTEMBER 1951

	Cents per pound
Premium grade of specially selected whole tire reclaim (sp.gr. under 1.20)..	10.50
First-line whole tire reclaim (sp.gr. under 1.20).....	10.00
Second-line whole tire reclaim.....	9.50
Third-line whole tire reclaim.....	9.25
Fourth-line whole tire reclaim.....	8.75
Black carcass-type reclaim.....	14.25
No. 1 grade light-colored carcass reclaim (sp.gr. 1.25 and under).....	20.75
No. 1 selected peel reclaim.....	11.75
Peel reclaim.....	10.50
Butyl tube reclaim.....	14.50
Special-purpose natural rubber black tube reclaim.....	21.00
Natural rubber black tube reclaim.....	20.00
Red tube reclaim.....	24.25
Gray tube reclaim.....	24.25

II

Competitive Materials

II

Competitive Materials

Rubber was competitive with *leather* in several of its earliest applications in the United States. The chief rubber product from 1830 to 1860 was waterproof rubber footwear, and today rubber heels and soles on footwear of various kinds have usurped a market once supplied by leather. Transmission belting, and fire hose (originally of leather) are other products where rubber has superseded leather.

During the past thirty years, rubber has made increasing inroads in cushioning applications. At first, simple chair-seat cushions of chemically blown sponge rubber found a wide vogue. Later, efforts to produce a bulk product suitable for wide use in upholstery were crowned with success through the development of latex patents leading to foam rubber. In the field of pillows and mattresses, vehicle seat cushioning and furniture springs, and general furniture upholstery, rubber cushioning has invaded fields formerly supplied by felt, horsehair, steel springs, and other materials. At varying price levels, however, these materials are still competitive.

To a certain extent, rubber products invaded fields formerly supplied wholly by textiles. Examples of this include textile transmission and conveyor belting and such fine rubber goods as aprons, bibs, baby pants, raincoats, and shower curtains.

During the last ten years, certain fields formerly supplied by rubber materials have felt increasing competition from non-rubber plastics. Even before that, pyroxylin coatings competed with rubber coatings on textile-base materials for various applications. Today many fine hard rubber specialties and novelties have been superseded by similar less expensive articles made from non-rubber plastics. Insulation on wiring for automobiles and electrical appliances, formerly rubber, is now often of plastics with better di-electric properties. Light raincoats, aprons, and bibs, and shower curtains are now more frequently made of plastics than of rubber. Plastic garden hose, recently introduced although relatively expensive, is finding increasing favor because of its lightness and durability.

III

Production Processes and Possible Problems

III

Production Processes and Possible Problems

A. NATURAL RUBBER

The planting of rubber trees, tapping, and preparation of rubber suitable for international trade, can be accomplished with simple equipment. That is the reason that production by native smallholders in the Far East has expanded so rapidly during the last twenty-five years. A native with two acres of mature Hevea trees, tapping with family labor, needs only tapping knives, tapping cups (coconut gourds can be used), pails to collect the latex, a coagulating tank (which can be made of wood), an acid coagulant (usually purchased, but can be homemade), a hand mangle for sheeting and pressing out excess water, and some bamboo poles on which to hang the wet sheets for air-drying. Smoked sheet can be prepared with a small smokehouse and wood fuel. He often transports his output to market on a bicycle. In Indonesia, wet sheet is sometimes rolled thin with a round bottle on a flat board, dispensing with the mangle.

Native rubber produced by crude methods and lacking cleanliness is cleaned and dried in remilling plants in the Far East before shipment to consuming markets. These plants require imported power equipment, sheeting machines, and baling presses. Lack of remilling facilities has retarded the movement of native rubber in international trade at various times. During August-September 1951, Indonesian regulations, intended to force increased local remilling, interfered with shipments of wet slabs to Malaya where most of the milling had been done since World War II.

For estate operations, aside from the labor requirements, the processes involve equipment and machinery on a scale in proportion to the size of the estate. This may involve bulldozers for clearing land for replanting, motor tank vehicles for transport of latex from collection points to the estate factory, power equipment to operate the factory, huge coagulating tanks and batteries of sheeting machines to prepare the rubber in dry form, or tanks for storage, and centrifuging or creaming equipment for concentration of latex, baling equipment, and trucks or pipe lines for transport of the dry rubber or latex to rail or shipping points. Imported acids, vehicles, and machinery are necessary to the estate operations, but except for power equipment and transport much improvisation is possible in an emergency.

Overseas transport is of course a point of vulnerability in case of war with an enemy strong in air, naval, and submarine power.

B. SYNTHETIC RUBBER

The plants established by our Government for the manufacture of GR-S, Butyl, and Neoprene during World War II are individually huge. The plants which produce Butadiene and Styrene, the feedstocks for GR-S, are also large. Butyl is produced in but two plants, Neoprene almost wholly in one. Fires and explosions which have occurred, in the Monsanto styrene plant in Texas, and at the Neoprene factories, sufficiently indicate the vulnerability of the synthetic rubber industry to bombing attacks or sabotage in time of war. From this viewpoint, the five styrene plants could be considered the points of key vulnerability for the entire GR-S production capacity. Strategic dispersal of plants, in more numerous small units, should be considered in connection with construction of any new facilities for either of these synthetics and the chief feedstocks.

GR-S is a copolymer of Butadiene and Styrene; initially in the ratio of roughly three to one. In 1949, the bound styrene content averaged about 23 percent. Since then, progress has been made in the production of GR-S with a lower bound styrene content and in the fourth quarter of 1951 approximately three-fourths of the output was of the 20 percent bound styrene type. Experiments with a lower bound styrene content are under way.

Styrene is mostly produced in facilities originally constructed by the Government to provide this material for use in the manufacture of GR-S. After the war, the plants with one exception were purchased by private firms, the Government retaining certain priority rights on styrene production. As the use of GR-S was

reduced from 1947 to 1949, and this market for styrene dwindled, the producers found a growing demand for styrene in plastics, resins and paints. With the expansion in production of GR-S in 1950-51, demand for styrene increased. As production capacity was approached, the Government supplies of styrene from the Government-owned plant plus quantities for which rights were retained in the disposal of other plants became less than the GR-S requirements. The deficit has been supplied voluntarily by the private producers. This unavoidably lessened the quantity of styrene available to the plastics industry and other private consumers, who have complained against the restriction of their supplies. Meanwhile, substantial expansion of the styrene production is under way.

Styrene has been derived from benzene (benzol) produced chiefly as a by-product of the production of coke for the manufacture of steel. The supply at a high rate, therefore, has been dependent on a high rate of steel production and coking operations. The benzene production from this source is in the order of 160 million gallons a year. In 1951, to secure needed supplies, we imported about 60 million gallons from England, France and Germany. Recently, the production of synthetic benzene from petroleum, but at a much higher price, is accounting for an increasing output. The scheduled annual rate from petroleum is 25 million gallons at the start and 90 million gallons at the end of 1952, the expansion being designed to assure dependable sources of supply. There are limited competitive seasonal demands for benzene in the production of benzene-derived chemicals such as dichlorobenzene moth crystals and other insecticides, and in detergents. Also, the aniline-based compounding materials employed in anti-oxidants and other organic chemicals widely used both in the production of synthetic rubber and in the manufacture of rubber products, are derived from benzene, and have used about five percent of its production.

Butadiene facilities were designed for the production of 489,200 tons capacity annually although demonstrated capacity is closer to 600,000 long tons. Of the ten plants in the Government program, all but two are designed for production from petroleum derivatives, butylene and butane. The remaining two, with design capacity of 140,000 short tons, use alcohol as their feedstock.

The cost of butadiene produced from petroleum fractions is much less than its cost produced from alcohol because alcohol is usually higher priced than butylene or butane. Except in times of high demand the alcohol plants are maintained in standby condition and production is concentrated in the more economical plants.

During World War II, the GR-S and butadiene demand for petroleum fractions was in competition with the aviation gasoline demand for high-octane gas, involving the same fractions. In case of another general war, the production of GR-S might again need to depend heavily on butadiene from alcohol plants.

Production of GR-S at a polymerization temperature of 122° Fahrenheit was the practice from the start of the program until 1948, when the development of cold GR-S was under experimental development. In 1949, production of GR-S polymerized at approximately 41° Fahrenheit amounted to 67,512 long tons; in 1950 it was 134,963 long tons. Currently, the Reconstruction Finance Corporation is authorized (1) to increase the capacity for production of GR-S by 100,000 tons to 860,000 long tons annually by removal of bottlenecks in existing plants, and (2) to convert facilities to cold rubber production to the extent of 75 percent of the total output.

GR-S statistics are recorded in terms of so-called "rubber hydrocarbon (RHC) content." For several years, master-batch GR-S with inter-mixed carbon black has been a regular item of production. In 1951, the production of oil-extended GR-S has received increasing attention. It has been found that the addition of low-priced oil in processing GR-S will increase the bulk of the resulting product without reducing its utility for a wide range of usage. By this process, adding 20 parts of oil to every 80 parts of RHC, a 25 percent increase in the volume of production is attained, at a lower average price per gross pound. This form of GR-S is also produced with intermixed carbon black. The gross weight of black GR-S and oil-extended GR-S needs to be distinguished from the RHC or net weight, as presently recorded in NPA statistics of production and consumption. In June 1951, the net weight of production of these types was 2,265 long tons, and output is expected to increase.

Considered from the long-term viewpoint, the fact that petroleum resources are not inexhaustible, while agriculture can be depended upon indefinitely to supply material for the production of alcohol, indicates that agriculture may become important in determining the sources of butadiene.

The outlook for continued increase in the world demand and the United States demand for new rubber, which is already beyond the world capacity for production of natural rubber, makes future growth of the production of chemical rubbers a virtual certainty, not only in the United States but in other important consuming countries. It can be assumed that the production will be based on the lowest-priced materials obtainable, and it is probable that in terms of gold values the cost of production per pound will gradually decline from the level of late 1951. To predict what may develop in the way of international competition in these materials would be extremely difficult, but presently, exchange difficulties would hamper foreign countries in making heavy purchases from the United States on a commercial basis.

C. RECLAIMED RUBBER

The collection and distribution of scrap rubber, particularly discarded tires and inner tubes, is the foundation of the rubber reclaiming industry. The following list of types of scrap rubber, regularly quoted in a leading trade journal, are indicative of the forms in which this material is purchased by reclaimers.

Table III C(1).—TYPES OF SCRAP RUBBER

- Mixed tires
- Mixed beadless tires
- Light colored carcass
- Black carcass
- No. 1 peelings
- No. 2 peelings
- No. 3 peelings
- Buffings
- Truck and bus s.a.g. (sorted and graded tire parts)
- Passenger s.a.g.
- Mixed s.a.g.
- Light colored tubes
- Natural rubber red tubes
- Natural rubber black tubes
- Mixed natural rubber tubes
- Butyl rubber tubes
- GR-S rubber tubes
- Mixed synthetic tubes

The collection and sorting of scrap rubber is mainly in the hands of waste material dealers. Several huge firms specialize in the business. Tire manufacturers who operate captive reclaiming plants also collect large quantities of tires and tubes through their dealers and company-owned stores.

The normal demand for scrap rubber is much less than the quantity that could be obtained if all worn-out rubber products were collected. Consequently, collections are usually limited to areas where motor vehicle registrations are heavily concentrated; these are the most economical collection areas. A worth-while index of the annual availability of scrap rubber by state areas could be constructed from statistics of motor vehicle registrations, and stated in terms of concentration per square mile or per 1,000 population, as an aid to collections in the more remote areas in any dire emergency.

In June 1942, the President proclaimed a scrap rubber collection drive to provide material for the greatly increased supply of reclaim needed for use in the war period before synthetic rubber production got under way. For purposes of this campaign, which had the whole-hearted cooperation of oil and rubber companies and their distributing agents and facilities throughout the nation, the Rubber Reserve Company

became the sole buyer and distributor of scrap rubber. Their subsequent reports summarize their activities as follows:

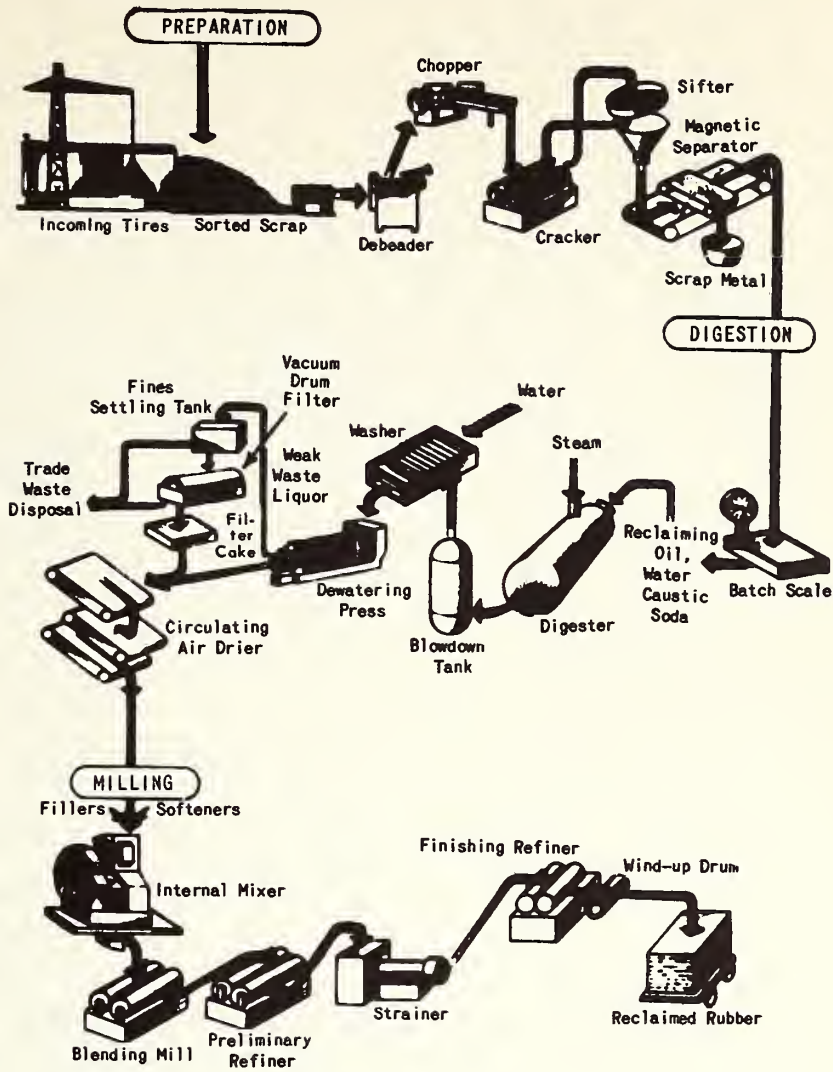
	Short tons	Long tons
Purchases.....	1,109,857	990,943
Sales.....	927,683	828,288
On hand 1/27/45....	182,174	162,655

In 1942-43, reclaimed rubber played an important part in providing material for the manufacture of required rubber products. Between 1943 and 1946 the use of reclaim declined but nevertheless remained fairly high. Further declines were evident through 1949. Despite increases in use in 1950 and the first half of 1951, private collections have provided all needed supplies of scrap rubber; with supplies of GR-S less restricted since mid-1951, the percentage use of reclaim declined sharply in the third quarter of the year.

The production capacity of the United States rubber reclaiming industry, demonstrated by actual production during the first six months of 1951, slightly exceeds 400,000 long tons annually. The previous production peaks were 304,000 tons in 1943, and 313,000 tons in 1950. Under normal circumstances, it will probably be several years before demand will again exceed current capacity; in case of general war, and particularly if synthetic rubber production was curtailed by sabotage or other developments, demand for reclaim might necessitate further expansion of facilities.

The reclaiming processes, whether simple regrinding of clean material free of fabric, or the preparation of the product by the full alkali process, does not involve any serious problems other than equipment and power. The firms engaged in this business are individually large, in most cases, and for a new firm to enter into the business on a worth-while scale would involve a large financial outlay. A chart, showing the flow of materials in the production of reclaim by the digester process, appears in III, C(2), p. 5.

FLOW DIAGRAM OF DIGESTER RECLAIMING PROCESS



IV

Raw Material Sources

IV

Raw Material Sources

A. NATURAL RUBBER

Table IV, A(1) indicates the approximate capacity of different countries for production of natural rubber by the estates for shipment as concentrated latex or as dry rubber, and by the natives or smallholders. The "capacity" as estimated here is intended to represent what could be produced at stimulating but not fantastically high prices in 1952 or 1953, if there were sufficient labor available to tap all mature trees in each area, and if there were no internal political or terrorist activities retarding the production. It is therefore an estimate of potential maximum production attainable under favorable conditions, not an estimate of probable output, since conditions pricewise, laborwise, and politically will certainly be less than ideal. The estimate for latex assumes at least an equivalent demand for natural rubber in that form.

Table IV, A(1).—NATURAL RUBBER, ESTIMATED POTENTIAL ANNUAL PRODUCTION
CAPACITY, 1952-53
[In 1,000 long tons]

Area	Estates		Natives	Total
	Latex	Dry		
Malaya.....	65	310	315	690
Indonesia.....	15	285	650	950
Ceylon.....	2	70	33	105
Thailand.....	.....	2	110	112
Indochina.....	5	70	5	80
Sarawak.....	.....	5	55	60
British North Borneo....	0.2	15	10	25.2
India.....	0.2	10	6	16.2
Burma.....	.....	8	5	13
Other Asia and Oceania...	0.3	5	.....	5.3
Tropical America.....	0.3	1	(wild) 30	31.3
Liberia.....	17	15	1	33
Other Africa.....	.....	24	5	29
Total.....	105	820	1,225	2,150

These statistics of primary potential sources would be of interest if a situation arose in which some areas were not accessible.

Much of the rubber produced in Indonesia, Sarawak, North Borneo, and Burma is moved to Malaya before shipment to consuming countries. The statistics of rubber exports from Malaya include both domestically-produced and imported rubber. The general tendency, however, is toward direct shipments from producing to consuming markets; Thai rubber, which formerly reached world markets through Malaya, is now mostly shipped direct. The import statistics of most countries report rubber arrivals "by countries whence imported" rather than "by countries of origin," the latter being impossible to ascertain accurately in the case of imported rubber that has been remilled and packed in Malaya.

The relative competitive strength of the different countries is a difficult matter to estimate, under current conditions. Before World War II, it was clear that the average yield per acre was low in Ceylon, India and Burma, resulting in relatively high costs in those areas; that is still the situation. In general, natives are lower-cost producers than estates, but their product sells at a discount below first quality estate grades of rubber, and if there should be a surplus of natural rubber, the lower grades would be most affected pricewise. Probably the efficient, high-yield estates are as strong, competitively, as the small native

producers, considering prospective relative demand and supply for the types of rubber which they produce.

B. SYNTHETIC RUBBERS

In the United States, the Government facilities for production of GR-S originally had a design capacity of 705,000 long tons annually. One Louisville plant with a design capacity of 60,000 long tons was sold after the war. Another 30,000 ton plant was cannibalized. The remaining plants, with a design capacity of 615,000 long tons, were in early 1951 rated capable of actually producing 760,000 tons annually of the types of GR-S then being produced. Expansion of this capacity to 860,000 tons annually has been authorized, and the Reconstruction Finance Corporation is under instructions to increase capacity to this rate as rapidly as possible. Instructions also provide for the refrigeration of facilities sufficient to produce 75 percent of the total in the form of cold rubber. The peak production of GR-S in the form of latex was 30,450 tons in the twelve months ended June 1951. The production of Oil-extended rubber is presently averaging about 2,000 tons monthly (RHC). Possibilities of speeding up the GR-S reaction time are constantly being studied; if it should prove feasible to multiply the output in a given period, there might result large changes in factory equipment and design, since the drying and handling equipment would have to be increased before the process could be adopted.

The United States facilities for the production of Butyl have a design capacity for 68,000 tons annually. These plants produced 74,105 tons in 1951 and actual capacity is approximately 90,000 tons. The Reconstruction Finance Corporation is drawing plans for construction of new facilities with annual capacity of 30,000 to 50,000 tons, but actual construction would require Congressional action and appropriations.

In the annual report of the Reconstruction Finance Corporation for fiscal 1951, issued in December, the Government-owned plants in the synthetic rubber program are listed with names of operators and capacity data. Table IV, B(1) lists the Butadiene and Styrene plants, IV, B(2) lists the Butyl plants, and IV, B(3) lists the GR-S copolymer plants as reported in this latest official tabulation.

Table IV, B(1).—OPERATORS OF GOVERNMENT-OWNED BUTADIENE AND STYRENE FACILITIES, AS OF JUNE 30, 1951

Operator	Plant location	Type of plant	Approx. prod. capacity, tons/yr.*
Cities Service Refining Company.....	Lake Charles, La...	Butadiene from Butylenes..	62,000
Copolymer Corporation.....	Baton Rouge, La....	Butadiene from Butylenes..	22,000
Humble Oil & Refining Company.....	Baytown, Texas.....	Butadiene from Butylenes..	45,000
Neches Butane Products Company.....	Port Neches, Tex...	Butadiene from Butylenes..	168,000
Sinclair Rubber, Inc.....	Houston, Texas.....	Butadiene from Butylenes..	78,000
Philips Chemical Company.....	Borger, Texas.....	Butadiene from Butane.....	60,000
Standard Oil Co. of Calif. & Shell Chemical Corp.....	Torrance, Calif....	Butadiene from Butane.....	45,000
Carbide & Carbon Chemicals Div. Union Carbide & Carbon Corp.....	Louisville, Ky.....	Butadiene from Alcohol....	70,000
Koppers Company, Inc.....	Kobuta, Penna.....	Butadiene from Alcohol....	105,000
The Dow Chemical Company.....	Torrance, Calif....	Styrene.....	57,000

* Butadiene and styrene, short tons/year.

Table IV, B(2).—OPERATORS OF GOVERNMENT-OWNED BUTYL RUBBER FACILITIES, AS OF JUNE 30, 1951

Operator	Plant location	Type of plant	Approx. prod. capacity, tons/yr.*
Esso Standard Oil Company.....	Baton Rouge, La.....	Butyl Rubber.....	40,000
Humble Oil & Refining Company.....	Baytown, Texas.....	Butyl Rubber.....	40,000

* Butyl Rubber, long tons/year.

Table IV, B(3).—OPERATORS OF GOVERNMENT-OWNED SYNTHETIC RUBBER COPOLYMER FACILITIES
AND OTHER COMPANY PARTICIPANTS, AS OF JUNE 30, 1951

Operator	Plant location	Approx. prod. cap. l.t./yr.	Other participating companies	Percent of partici- pation
Firestone Tire & Rubber Co.	Lake Charles, La..	86,000	None.....	
	Akron, Ohio.....	25,000	Carlisle Corp., Carlisle, Pa.....	10
B. F. Goodrich Chemical Co.	Port Neches, Tex..	78,000	None.....	
	Institute, W. Va..	113,000	Denman Rubber Co., Warren, Ohio.....	10
Goodyear Synthetic Rubber Corp.	Houston, Texas....	87,000	None.....	
	Akron, Ohio.....	23,000	General Latex & Chemical Corp., Cambridge, Mass..	35
			Mohawk Rubber Co., Akron, Ohio.....	10
United States Rubber Co.	Port Neches, Tex..	76,000	None.....	
	Naugatuck, Conn...	25,000	Cooper Tire & Rubber Co., Findlay, Ohio.....	10
General Tire & Rubber Co.	Baytown, Texas....	37,000	McCreary Tire & Rubber Co., Indiana, Pa.....	5
Phillips Chemical Co.	Borger, Texas.....	54,000	None.....	
Midland Rubber Corp.	Torrance, Calif...	76,000	Pacific Rubber Co., Oakland, Calif.....	35
*Copolymer Corp..	Baton Rouge, La...	43,000	Armstrong Rubber Co., West Haven, Conn.....	12.5
			Armstrong Rubber Mfg. Co., Des Moines, Iowa.....	12.5
			Dayton Rubber Co., Dayton, Ohio.....	12.5
			Gates Rubber Co., Denver, Colorado.....	12.5
			Lee Rubber & Tire, Conshohocken, Pa.....	12.5
			Mansfield Tire & Rubber, Mansfield, Ohio.....	12.5
			Sears, Roebuck & Co., (incl. Armstrong T&R, Natchez, Miss. in which Sears, Roebuck & Co. owns 50% of the voting stock).	12.5
			Sieberling Rubber Co., Akron, Ohio.....	12.5
*Kentucky Synthetic Rubber Corp.	Louisville, Ky....	37,000	American Hard Rubber Co., New York, N. Y.....	10
			Boston Woven Hose & Rubber Co., Boston, Mass....	10
			Brown Rubber Co., Inc., Lafayette, Ind.....	10
			Hewitt-Robbins, Inc., New York, N. Y.....	10
			Goodall Rubber Prod. Co., Trenton, N. J.....	10
			Sponge Rubber Prod. Co., Shelton, Conn.....	10
			Sheller Mfg. Corp., Portland, Ind.....	10
			Simplex Wire & Cable Co., Cambridge, Mass.....	10
			Thiokol Corp., Trenton, N. J.....	10
			Raybestos-Manhattan Inc., Passaic, N. J.....	10
Total.....		760,000		

*Copolymer Corp. and Kentucky Synthetic Rubber Corp. are each separate corporations which are wholly owned by the companies listed as equal stockholders.

Neoprene facilities privately owned during the war had a production peak of 10,623 tons in 1946. The Government-constructed facilities at Louisville had a design capacity of 60,000 tons, but after the war, one 15,000 ton unit was cannibalized. This plant was sold to du Pont in January 1949, and that company since then has been the sole producer. In 1951 they rehabilitated the extra 15,000 ton unit and production capacity is now about 70,000 tons annually. The peak production of Neoprene in the form of latex was 13,595 tons in 1946.

N-Type synthetic rubbers are all privately produced, by the four leading manufacturing companies—Firestone, Goodrich, Goodyear, and U. S. Rubber. Production in June-August 1951 attained its peak rate of 17,412 tons a year; the capacity may be 20,000 annually. Production in the form of latex averaged 237 tons monthly during the first nine months of 1951.

In Canada, the peak production of synthetic rubbers was in 1950—41,893 long tons of S-Type rubbers, 12,921 tons Butyl, and 3,646 tons of other types—a total of 58,440 long tons.

Germany had a peak production of 115,754 long tons of synthetic rubbers in 1943. After the war, the plants in the western zone were eventually dismantled. In 1951, steps have been taken to reestablish a minor production, and output of Buna S at a rate of 500 tons a month starting November is planned at the Huls plant in Westphalia. Bayer-Werke at Leverkusen can start manufacturing Perbunan (N-Type) at a rate of 120 tons a month as soon as it can obtain the necessary butadiene, but because of dismantling will not be able to produce Buna S rubber for at least two years. A reconstruction of the Huls plant that would permit production at a rate of 1,800 tons monthly two years hence is also possible. An output of 10,000 tons annually for all types is the maximum to be expected in Germany in 1952 and 1953, recent reports indicate.

Estimates of Russian synthetic rubber production in 1948-49 were about 200,000 tons, and for 1950-51 about 250,000 tons. There are no accurate authoritative statistics for either the Russian production or consumption of rubber.

If growth in world rubber consumption continues, and if natural rubber production should be unable to meet demand with ample supplies at competitive prices as the years pass, it would be expected that additions to the production capacity for synthetic rubber might be considered in various countries, particularly since new supplies could thus be obtained within two or three years, compared with the seven to ten years needed to plant and grow a natural rubber plantation to maturity. Any sharply rising demand for rubber could not well be satisfied by starting new plantations.

It appears probable that the costs of producing synthetic rubber will have a tendency to fall, as a result of new developments in materials and processes in this young industry. The cost of producing different types varies substantially; this will doubtless continue. Varying costs and supply-demand factors for GR-S subtypes, particularly in case of private ownership of producing facilities, would probably come to be reflected in different selling prices for the sub-types. The oil-extended rubber opens wide price possibilities. Since alcohol-based butadiene is relatively expensive, privately-owned plants would presumably be based on the less costly butadiene from petroleum. Under private ownership, taxes and profits would have to come from the sales dollar, and would tend to raise the selling prices to that extent. It appears probable that synthetic rubber will in future be generally used not only in applications where it is definitely superior, but also wherever it can be used interchangeably with natural rubber unless natural rubber sells at an equal or lower price.

C. RECLAIMED RUBBER

The production of reclaim is a concomitant of the rubber-manufacturing industry in nearly every consuming country of importance. Traditionally, use of reclaim has been discouraged in the United Kingdom and many of its possessions because of the dominant Empire interest in natural rubber production. In the United States and elsewhere, from 1900 to the time when synthetic rubber production assumed importance, reclaim represented the first line of strategic defense against scarcity of and economic defense against high prices for natural rubber. In the countries which now produce synthetic rubbers, these materials have superseded reclaim strategically, and they have made inroads on the economic position formerly occupied by reclaim.

Although the percentage use of reclaim has shown a declining tendency in the United States since the advent of large-scale production of synthetic rubbers, the total new rubber consumption has increased so much that the tonnage use of reclaim has been well maintained, and since reclaimers have not suffered serious reduction in tonnage demand the economic trend has not occasioned much comment. The unusual demand for reclaim in the last half of 1950 and the first half of 1951 pushed production to a new high record, while new rubber was in scanty supply. With GR-S in more ample supply, the demand for reclaim subsided during the third quarter of 1951, and the reclaiming industry is retrenching. It appears doubtful whether they will

again be called upon to produce reclaim at a rate of 400,000 tons a year, as they were in the first half of 1951, for many years to come, provided supplies of general purpose synthetic rubber continue easy to obtain.

Labor costs, and transportation costs, involved in the collection, sorting and distribution of scrap rubber, have increased considerably since 1946. A large plant investment is required for production of reclaim, which is dependent for much of its market on its ability to supply an adequate substitute for new rubber at a low price. Reduced demand for reclaim will no doubt be followed by lower prices for scrap rubber in due course, but the possibilities of reducing selling prices of reclaim are limited except for special items, such as butyl tube reclaim.

V

Raw Material Production

Raw Material Production

A. NATURAL RUBBER

The production of natural rubber by chief countries, with sub-totals by continents, is shown in table V, A(1). The statistics cover rubber in dry forms and in the form of latex. Production is concentrated mostly in Southeast Asia and nearby islands, where the plantation rubber industry became the chief source of the world's supply in 1912. The rubber produced in tropical America is from trees growing wild, with negligible exceptions. Since the start of plantation production in Liberia by Firestone, production in Africa has shown a steady increase which may portend a significant shift of the industry in that direction in the future.

The production of rubber in the Far East was influenced by international regulation of production from 1935 to 1941, by World War II through 1946, and by disturbed political and economic conditions since 1946. In the regulation period, the production in what is now Indonesia was more severely restricted than elsewhere because the quota for the native producers there was much lower than productive capacity. During the war, Ceylon and India continued in Allied control; Indochina was the only country under Japanese control which maintained production at a high rate through 1944; production in Africa and tropical America was stimulated by special programs. Since the war, Indochina has not in any year produced much more than half its potential output, because of guerilla warfare, and Malayan production since 1948 has been affected by guerilla activities which continue unabated.) In Indonesia, political, labor, and tax conditions have prevented the large estates from attaining output equal to 60 percent of their capacity, and the production by Indonesian natives was far below capacity until 1950 and 1951 when their output was stimulated by the extremely high prices for rubber. Production in 1950 was near the capacity of areas other than Indonesia and Indochina, but because of the below-capacity output there and in the wild rubber regions, world production was only 86 percent of the potential world capacity as previously estimated.

In this connection, much of the planted rubber in Ceylon and Malaya, and some elsewhere, consists of old low-yield trees which are really already obsolescent. The present potential capacity in the Far East probably will not be maintained many years in the absence of new planting or replanting, and although current price conditions would normally stimulate expansion, the disturbed social and economic conditions there are discouraging if not prohibitive factors, particularly for large estates.

Three American firms—Firestone with plantations in Liberia; Goodyear in Sumatra, the Philippine Islands and Costa Rica; and U. S. Rubber Company in Malaya and Sumatra—account for around 5 percent of the total world production of natural rubber.

While small shipments of rubber latex were made in very early years of rubber manufacturing, a volume trade first developed after World War I. The growing demand was supplied almost exclusively from Malaya and Indonesia until the middle 1930's. Table V, A(2) shows the exports from the producing countries since 1935, in terms of long tons dry rubber content. Malaya is the chief source, and Liberia has been the next largest source since the war. Indonesian facilities began to be rehabilitated in 1950, and in 1951 they would have rivaled Liberia in volume of shipments but for the sharp decline in United States demand for natural latex which led to general curtailment of shipments to the American market. In 1950, about 5 percent of the natural rubber produced was shipped as latex. In this production field, the plantations operated by Firestone, Goodyear, and U. S. Rubber are important factors.

Table V, A(1).—ESTIMATED WORLD PRODUCTION OF NATURAL RUBBER, 1935-50 (1,000 LONG TONS)

	1935	1936	1937	1938	1939	1940	1941	1942
Malaya.....	376.8	363.7	501.1	359.5	360.1	547.2	600.0	155.0
Indonesia.....	282.9	309.6	450.7	317.2	378.2	543.2	650.0	200.0
Ceylon.....	54.3	49.7	72.5	50.0	60.0	90.0	99.5	101.5
Thailand.....	28.3	34.6	35.6	41.6	41.8	43.9	45.5	11.5
Indochina.....	28.7	40.8	48.0	60.0	68.0	64.0	74.9	76.2
British Borneo.....	29.7	30.5	40.0	28.2	37.1	54.6	57.0	10.0
India.....	12.3	13.6	14.4	12.5	14.0	16.7	16.3	16.6
Burma.....	9.4	13.2	10.2	8.9	6.6	9.8	8.8	.3
Other Asia & Oceania.....	1.5	1.6	1.8	1.9	2.1	3.9	2.3	.9
Total.....	823.9	857.3	1,174.3	879.8	967.9	1,373.3	1,554.3	572.0
Brazil.....	12.4	15.5	15.1	13.5	14.1	18.6	16.9	22.2
Other America.....	1.6	2.8	6.1	5.7	6.1	7.4	8.9	13.6
Total.....	14.0	18.3	21.2	19.2	20.2	26.0	25.8	35.8
Liberia.....	.8	1.6	2.3	2.9	5.4	7.2	8.4	12.1
Belgian Congo.....	.8	.8	1.0	1.1	1.1	1.2	1.3	1.6
Nigeria.....	2.1	2.2	2.6	3.1	2.8	2.9	2.1	6.7
Other British Africa.....	.7	1.1	1.2	1.3	1.5	1.6	1.3	2.9
French Africa.....	1.7	2.5	4.0	3.4	3.6	2.9	3.5	5.6
Other Africa.....	.1	.2	.5	.1	.2	.3	.4	.8
Total.....	6.2	8.4	11.6	11.9	14.6	16.1	17.0	29.7
Grand total.....	844.1	884.0	1,207.1	910.9	1,002.7	1,415.4	1,597.1	637.5
	1943	1944	1945	1946	1947	1948	1949	1950
Malaya.....	75.0	25.0	8.6	403.7	646.4	698.2	671.5	694.1
Indonesia.....	100.0	50.0	10.0	175.0	278.0	432.3	431.8	692.8
Ceylon.....	105.5	98.5	97.5	94.0	89.0	95.0	89.5	113.5
Thailand.....	4.8	.....	.....	24.2	52.6	95.9	94.2	112.2
Indochina.....	70.4	60.4	12.0	20.0	38.1	43.9	43.0	48.5
British Borneo.....	5.0	.....	.....	14.3	53.7	61.8	60.7	82.0
India.....	16.6	17.3	16.1	15.8	16.4	15.4	15.6	15.6
Burma.....	.....	.....	.6	5.6	8.6	9.1	8.5	10.6
Other Asia & Oceania.....	.9	1.9	2.0	1.6	2.7	3.1	2.2	3.7
Total.....	378.2	253.1	146.8	754.2	1,185.5	1,454.7	1,417.0	1,773.0
Brazil.....	23.1	29.4	24.1	23.7	25.9	20.2	21.3	19.9
Other America.....	18.8	20.5	23.0	16.0	9.0	9.0	6.0	7.5
Total.....	41.9	49.9	47.1	39.7	34.9	29.2	27.3	27.4
Liberia.....	14.4	18.1	19.9	20.7	22.8	24.7	26.6	29.3
Belgian Congo.....	7.8	11.1	7.8	4.5	4.0	4.9	6.8	8.1
Nigeria.....	7.4	9.4	9.9	11.5	7.4	8.0	6.8	13.4
Other British Africa.....	5.1	4.3	4.9	2.9	.7	.7	.5	.3
French Africa.....	8.0	10.4	9.4	5.6	3.5	3.2	2.4	2.0
Other Africa.....	2.2	1.6	1.8	1.7	.1	.1	(*)	.2
Total.....	44.9	54.9	53.7	46.9	38.5	41.6	43.1	53.3
Grand total.....	465.0	357.9	247.6	840.8	1,258.9	1,525.5	1,487.4	1,853.7

* Less than 50 tons.

Source: Rubber Division, NPA.

Table V, A(2).—NET EXPORTS OF NATURAL RUBBER LATEX FROM PRODUCING COUNTRIES 1935-1950

[In long tons]

Year	Malaya	Indonesia	Ceylon	Indochina	British North Borneo	Liberia	Others	Total
1935.....	13,150	7,543	20	10	74	191	.....	20,898
1936.....	16,936	10,684	5	31	129	709	.....	28,494
1937.....	19,408	13,651	4	7	307	1,139	.....	34,516
1938.....	14,931	6,181	1	1	446	1,386	.....	22,946
1939.....	22,497	17,615	6	7	363	2,586	.....	43,074
1940.....	22,269	17,559	10	7	644	4,259	.....	44,748
1941.....	19,202	^e 20,000	32	^e 10	^e 750	4,326	.....	44,320
1942.....	827	n.a.	40	.....	.....	6,147	.....	7,014
1943.....	n.a.	.....	15	.....	.....	1,659	.....	1,674
1944.....	n.a.	.....	.....	.....	.....	4,416	.....	4,416
1945.....	142	.....	15	.....	.....	5,036	23	5,216
1946.....	5,341	^e 39	39	10	^e 2	6,909	1	12,341
1947.....	26,595	^e 53	446	170	.....	9,168	96	36,528
1948.....	39,956	18	625	241	.....	6,006	224	47,070
1949.....	45,731	1,397	879	293	.....	7,720	163	56,183
1950.....	73,218	7,607	1,272	634	.....	15,013	n.a.	97,744

^e Estimated.

n.a. Not available.

Source: Rubber Statistical Bulletin, Secretariat of the International Rubber Study Group.

While natural rubber is not produced in the United States at present, the subject has not been ignored. Before 1900, abortive efforts were made to launch Hevea plantations in Florida or Louisiana. The guayule shrub has since 1905 been the subject of private and governmental study and experiment, and the Intercontinental Rubber Company produced rubber from domestically planted shrub in the 1920's. During World War II, over \$33 millions was expended in connection with a domestic guayule production program, which was abandoned after fighting ceased. Thomas Edison devoted considerable study to guayule, goldenrod, cryptostegia, and other plants capable of producing rubber within the United States in 1926-28. Appropriations for the Bureau of Plant Industry Department of Agriculture, since the early 1920's at least, have provided funds earmarked for the study of and experimentation with domestic and imported plants which in time of emergency, might be used to produce natural rubber in this country, or elsewhere in the Western hemisphere. A great deal of progress in yield improvement from guayule has been made. The development of synthetic rubber and the strategic stockpiling of natural rubber have not ended these endeavors, but the chance that in any emergency this country would undertake a domestic natural rubber production program on a scale capable of caring even for our minimum needs now seems remote.

During the 1922-28 period of British Restriction of Rubber Production, designed to assure profitable operations for the rubber plantation industry in British Colonies, the United States Government made a survey of natural rubber production possibilities throughout the world, with a view to stimulating production in areas free of control, and particularly in Latin America as a factor in our hemispheric defense. As a by-product and aftermath of the high prices of rubber in 1925-27, Firestone engaged in the production in Mexico and Liberia, Goodyear in the Philippines, Panama, and Costa Rica, and the Ford Motor Company in Brazil. The efforts in Mexico, Panama, and Brazil have been abandoned by these companies. The start of World War II led our Government to enter into cooperative agreements with various tropical American Governments with a view to developing Hevea plantations with high-yield trees resistant to the destructive South American leaf disease, in an effort to stimulate rubber production in this hemisphere. Considerable success has been attained in the technical development of suitable trees, but thus far the plantation development consists only of experimental plots.

B. SYNTHETIC RUBBER

In the United States, before the Pearl Harbor attack, production of synthetic rubber was entirely in private hands. In 1941, du Pont was producing Neoprene, a few leading rubber manufacturing companies were producing N-Type rubbers, a small quantity of high-styrene butadiene-styrene rubber was being turned out, and the Standard Oil Company of New Jersey was able to make Butyl in its pilot plant at Baton Rouge.

The conquest of Southeast Asia by Japan leaving the Allies only Ceylon and India as sources of natural rubber in the Far East, forced the United States Government to launch its huge synthetic rubber program to provide rubber materials which, with stockpiled natural rubber, would permit continuing production of essential rubber products for the duration of the war.

The first requisite was a large tonnage of general purpose synthetic capable of replacing natural rubber in a wide range of uses, and particularly in tires and camelback; for this, the butadiene-styrene copolymer (roughly, three parts of butadiene to one part of styrene) was chosen, and plant construction included 15 copolymer factories with a design capacity of 705,000 long tons of GR-S. Neoprene, although much higher in cost, also had a prospective wide application, and the program provided additional facilities with a capacity of 60,000 long tons. The design capacity of Butyl facilities was 68,000 long tons; at the time, this rubber's suitability for inner tubes had not been generally recognized. The technical knowledge of all American firms and individuals, and all patents of record were pooled in planning the processes and the design and construction of the factories. That the entire program was so highly successful is rightly rated as one of the outstanding industrial achievements of World War II.

As a concomitant of the program, Canada undertook a program for the annual production of 50,000 long tons of chemical rubbers annually, three fourths of the styrene type, and one fourth Butyl.

Table V, B(1), shows the production of synthetic rubbers in the United States and Canada, by types, from 1940 through 1950. Near capacity output for Neoprene was achieved in 1944 somewhat in advance of GR-S; Butyl output was retarded by extremely difficult problems of plant construction and operation of the processing of this little-known material, and full output was not attained until 1946, after the war ended. The actual production of GR-S, in 1945, exceeded the design capacity of the facilities.

Table V, B(1).—PRODUCTION OF SYNTHETIC RUBBER IN UNITED STATES AND CANADA

[Long tons]

Year	UNITED STATES						CANADA				Grand total
	S-Type		Butyl	Neo-prene	N-Type	Total	S-Type	Butyl	Other	Total	
	GR-S	Private									
1939.....	.....	.....	.....	1,738	12	1,750	.....	.....	.....	.....	1,750
1940.....	.....	.....	.....	2,469	91	2,560	.....	.....	.....	.....	2,560
1941.....	.....	227	.....	5,692	2,464	8,383	.....	.....	.....	.....	8,383
1942.....	2,276	1,445	23	8,956	9,734	22,434	.....	.....	.....	.....	22,434
1943.....	181,470	789	1,373	33,603	14,487	231,722	2,522	.....	.....	2,522	234,244
1944.....	668,831	1,437	18,890	56,660	16,812	762,630	32,062	2,767	.....	34,829	797,459
1945.....	717,693	1,711	47,426	45,672	7,871	820,373	36,638	9,079	.....	45,717	866,090
1946.....	612,687	721	73,114	45,766	5,738	740,026	38,770	12,211	.....	50,981	791,007
1947.....	405,496	2,273	62,820	31,495	6,618	508,702	35,314	7,079	.....	42,393	551,095
1948.....	390,240	3,640	52,603	34,848	7,012	488,343	32,242	7,952	261	40,455	528,798
1949.....	288,882	6,284	52,237	35,215	11,072	393,690	37,333	7,047	2,262	46,642	440,332
1950.....	350,801	7,447	55,832	50,067	12,037	476,184	41,873	12,921	3,646	58,440	534,624

Source: Rubber Division, NPA, and Secretariat of the International Rubber Study Group.

After the war, as imports of natural rubber from Southeast Asia were resumed, the demand for chemical rubbers and particularly GR-S declined year after year through 1949, and the production in the United States was reduced accordingly. In Canada, however, by exporting output in excess of Canadian demand to the United States and elsewhere at a slight discount below the United States GR-S and Butyl prices, the production was well sustained and overhead expenses spread over a volume of business that, in the aggregate, was profitable.

The program for increased production of chemical rubbers in 1950 and 1951 has been discussed in a previous section. Production of GR-S in the third quarter of 1951 was at the annual rate of nearly 760,000 long tons; whether there will be need for production at the authorized rate of "860,000 tons as soon as possible" is uncertain.

The United States production of synthetic latices is shown, for GR-S and Neoprene, in Table V, B(2). Neoprene latex was finding some applications before the United States entered World War II, and this use increased as natural latex consumption was restricted. Demand for GR-S latex likewise grew rapidly in 1944, 1945, and attained a peak in 1946. Then as natural latex became obtainable in increasing quantities, demand for and production of the synthetic latices declined until 1950. In 1950, the high prices for natural latex and the improved qualities of cold GR-S latex combined to stimulate increased use of the latter in foam latex products. There is also a production of N-Type latex, but statistics have first been compiled in 1951, showing production of 2,131 long tons in nine months. High-styrene S-Type latices are also privately produced, finding application in so-called rubber paint.

The German production of chemical rubbers is shown in Table V, B(3). A small output was permitted by the Allies in the British Zone after the defeat of Germany until June 1948, when it was discontinued, and plants were dismantled. Renewed production was authorized and started in November 1951. Data on the production in Eastern Germany under Russian jurisdiction since 1945 has not been reported.

Table V, B(2).—U. S. SYNTHETIC LATICES PRODUCTION, 1941-50

[Long tons]

Year	GR-S	Neoprene	Total	Year	GR-S	Neoprene	Total
1941.....	.....	59	59	1946.....	24,810	13,603	38,413
1942.....	.....	210	210	1947.....	22,474	6,089	28,563
1943.....	194	1,512	1,706	1948.....	21,018	5,022	26,040
1944.....	6,580	4,683	11,263	1949.....	19,761	3,651	23,412
1945.....	15,176	7,077	22,253	1950.....	28,515	5,725	34,240

Source: NPA, Rubber Division, compiled from reports by producers.

Table V, B(3).—SYNTHETIC RUBBER PRODUCTION IN GERMANY*, 1937-49

[Long tons]

Year	Buna S	Buna N	Others**	Total	Year	Buna S	Buna N	Others**	Total
1937.....	2,076	394	627	3,097	1943.....	108,822	3,598	3,334	115,754
1938.....	3,931	630	834	5,395	1944.....	95,953	3,122	2,549	101,624
1939.....	20,251	1,108	638	21,997	1945.....	.....	.....	.....	.....
1940.....	36,550	1,868	1,408	39,826	1946.....	14,945	.....	612	15,557
1941.....	64,848	2,589	1,924	69,361	1947.....	7,835	.....	394	8,229
1942.....	92,678	2,779	2,678	98,135	1948.....	3,388	.....	.....	3,388

*British Zone only from 1945.

**From 1937 to 1944 "N" types shown separately, while from 1945 onward the term "others" includes "N" types.

Production Buna S in 1937-38 in one small plant was not available and Buna was estimated.

The production data for 1944 for both rubbers mentioned were for the same plant and were not available after October 26, 1944.

The production of synthetic rubber was discontinued in the summer of 1948 (see HICOG Report 29, 1/11/50).

Source: SHAEF Restricted Report and Rubber Statistical Bulletin.

The amount of synthetic rubber produced in Russia is unknown. Russia began producing synthetic rubber some time before 1930. In the 1931-35 period, the Russian imports of natural rubber averaged 35,000 long tons a year, and in 1936-40 approximately 30,000 long tons a year. It is a reasonable probability that the production of synthetic rubbers averaged less than 50,000 long tons a year in 1930-35, and less than 100,000 long tons a year in 1936-40. During the war, as Russia was invaded, some plants were probably destroyed, some moved inland beyond the occupied area. In 1948-50, Russian imports of natural rubber averaged 96,000 long tons annually; probably a substantial tonnage was stockpiled, but the consumption must have at least doubled over prewar years. Considering possible ratios of use of natural rubber with synthetics, and bearing in mind that facilities for synthetic production existed in Eastern Germany at the time of Russian occupation and that Russian satellite areas probably obtain some synthetics from Russia, a Russian area production around 200,000 tons of synthetics in 1949 might be guessed, and a production of 250,000 tons in 1951 appears probable.

C. RECLAIMED RUBBER

The production of, and demand for, reclaimed rubber in the United States has a tendency to increase with rising prices for new rubber, and to decline with falling prices. In Table V, C(1), this tendency is clearly indicated, the production being shown alongside the average declared value per pound of all imports of natural rubber (guayule, latex, and other), and with the average daily spot market price for No. 1 Ribbed Smoked Sheet.

The all-time peak production was attained in the first half of 1951, at an annual rate of 400,000 long tons. The abnormality of this rate is evident in comparison with the past record. Only in a serious emergency is the rate likely to be required for a full year, during the next several years.

Table V, C(1).—U. S. PRODUCTION OF RECLAIMED RUBBER; UNITED VALUE OF NATURAL RUBBER IMPORTS; MARKET PRICE OF NO. 1 R.S.S., 1935-50

Year	Reclaim production long tons	Natural rubber imports value per lb. cents	#1 R.S.S. market price cents	Year	Reclaim production long tons	Natural rubber imports value per lb. cents	#1 R.S.S. market price cents
1935.....	119,900	11.4	12.4	1943.....	304,000	27.1	22.5
1936.....	142,000	14.9	16.4	1944.....	260,600	31.2	22.5
1937.....	185,000	18.5	19.4	1945.....	243,300	31.4	22.5
1938.....	122,400	14.1	14.6	1946.....	295,600	27.2	22.5
1939.....	186,000	16.0	17.6	1947.....	291,400	20.0	20.8
1940.....	209,000	17.4	20.1	1948.....	266,900	18.8	22.0
1941.....	274,000	18.2	22.4	1949.....	224,000	16.2	17.6
1942.....	285,100	18.9	22.5	1950.....	313,000	25.5	41.2

Source: Rubber Division, NPA, and Predecessor Agencies.

Statistics for reclaimed rubber production are recorded for only a few countries. Some production is carried on in every important rubber manufacturing country. Russia probably has a capacity for producing around 40,000 long tons of reclaim annually; France probably has a capacity for producing 30,000 tons annually. Production in the leading foreign countries for which statistics are available are shown in Table V, C(2). The responsiveness of reclaim production abroad to higher natural rubber prices in 1950 and 1951 was marked; in the first half of 1951 the production in the United Kingdom was at an annual rate of 35,000 long tons, and in Germany 30,000 long tons.

Table V, C(2).—PRODUCTION OF RECLAIMED RUBBER IN CERTAIN FOREIGN COUNTRIES
[In long tons]

Year	United Kingdom	Germany	Australia	Canada
1945.....	22,317	n.a.	5,819	3,307
1946.....	27,798	n.a.	6,410	3,967
1947.....	22,431	n.a.	5,973	4,125
1948.....	24,614	n.a.	5,305	4,323
1949.....	20,946	24,147	5,899	3,475
1950.....	30,083	24,500	8,248	4,456

n.a. Not available.

Source: Rubber Statistical Bulletin.

VI

United States Imports, Exports, and Reexports

United States Imports, Exports, and Reexports

A. NATURAL RUBBER

In the period between World War I and II, the capacity for natural rubber production was greater, broadly speaking, than the world demand for rubber. The actual production was restricted by the Stevenson Rubber Restriction Scheme effective in British possessions in the Far East from November 1, 1922, through October 31, 1928, and by the International Rubber Regulation Agreement effective throughout the rubber-producing countries in the Far East from June 1, 1934 until their conquest by Japan in early 1942. Under the terms of the regulations, however, it was always possible to bid prices high enough to result in production in excess of demand, although sometimes unreasonably high prices occurred before the supply was forthcoming. By and large, therefore, this was a period of plentiful supply of natural rubber. In that period, there developed a philosophy that there always would be enough natural rubber to meet world needs; it was only necessary to pay high enough prices to bring out any amount normally required for United States imports.

The United States imports were made in part (about 40 percent of the total) by manufacturers who imported direct from their plantations and purchasing offices in producing areas, and in part (about 60 percent of the total) by rubber importers and dealers who distributed to manufacturers the types and qualities desired by each. The dealers are organized in the Rubber Trade Association of New York. New York City is the principal port of entry for rubber, where all dealers maintain their head offices.

The imports of rubber were entirely in the hands of private trade until 1939, when our Government through the Commodity Credit Corporation bartered 500,000 bales of cotton for 86,000 tons (advance estimate) of rubber, delivered during the next year, in a deal with the British Government. In late 1940, the Reconstruction Finance Corporation was instructed to accumulate stocks of rubber for a strategic Government stockpile, and in 1941 the Commodity Credit stocks were merged with those of the Rubber Reserve Company of R.F.C., which used American manufacturers as buying agents. Subsequently, for the duration of the war, the Government took jurisdiction over all imports of natural rubber, and the importing function was placed in the Rubber Development Corporation (originally in the R.F.C., later in Foreign Economic Administration) where it remained through March 31, 1947. Then private importation was again permitted, the Government continuing also to buy for the national strategic stockpile through the General Services Administration, mostly through private American importers and dealers.

Since World War II, the world annual production of natural rubber has regularly been less than the world consumption of new rubber (natural and synthetic). Foreign nations, except Russia and Canada, do not produce synthetic rubber, and lack American exchange with which to buy it from the United States, which in fact has seldom had supplies for export. Several countries are directly and deeply interested in the economic welfare of the natural rubber producing areas, through large investments of their citizens. Consequently, foreign countries except Russia and Canada have used natural rubber almost exclusively in making rubber products. In addition several foreign governments have small strategic stockpiles of natural rubber. The circumstances compel foreign importers to fill their needs by competitive purchase of natural rubber. The effect is the same as if foreign countries had a priority of claim on the supplies of natural rubber. The United States imports of rubber since the war represent the residue of world production after foreign demand has been satisfied.

The stockpiling purchases of natural rubber by the United States Government further reduce the quantities available to our domestic industry. The industry can obtain natural rubber only to the extent of the surplus of the world production over foreign purchases and United States Government stockpiling purchases, without putting undue strain on the market. Industry practice broadly has been to use natural rubber, from 1947 through early 1950, to the extent of this surplus and, in addition,

to use as much synthetic rubber as was necessary to satisfy requirements. In 1950, however, the amount of synthetics produced did not suffice industry needs. The American industry was thus the residual buyer of natural rubber until the Government again became the sole importer in December 1950, since when the General Services Administration has been in that position. Each time GSA has attempted to buy aggressively, the result has been chiefly to force a higher price for rubber, without reducing the purchases by foreign buyers who always can outbid them for the small amounts which each individually requires.

Tables under section VI, A include: (1) a statement of our annual gross imports, reexports, and net imports of natural rubber from 1925 to 1950; (2) gross imports of natural rubber by chief sources from 1936 to 1950; (3) imports of natural latex by chief sources; (4) percentages of total imports by ports of entry for representative years since World War II; and (5) imports of natural rubber by types in 1948, 1949, and 1950 as reported by the Rubber Manufacturers Association and the Rubber Trade Association of New York.

The United States, while still by far the leading market for natural rubber, now buys much less than half the world production even though our purchases include a huge tonnage for the strategic stockpile. Foreign countries in the aggregate use much more natural rubber than the United States, and their imports have been increasing annually. The influence of the United States on natural rubber producing regions might be expected to decline if our import percentage of the world production of natural rubber diminishes, as it probably will when our stockpiling ceases. We need to determine in advance what we will do if they appeal to us for aid.

Table VI, A(1).—U.S. GROSS IMPORTS, REEXPORTS AND NET IMPORTS OF NATURAL RUBBER, 1925-50
[Long tons]

Year	Gross imports	Reexports	Net imports	Year	Gross imports	Reexports	Net imports
1925.....	400,423	14,827	385,596	1938.....	412,092	5,652	406,440
1926.....	417,643	17,671	399,972	1939.....	499,616	13,125	486,491
1927.....	431,246	27,775	403,471	1940.....	818,624	7,060	811,564
1928.....	439,731	32,159	407,572	1941.....	1,029,176	5,376	1,023,800
1929.....	565,087	36,485	528,602	1942.....	282,445	10,856	271,589
1930.....	487,628	30,205	457,423	1943.....	59,926	22,583	37,343
1931.....	501,788	25,609	476,179	1944.....	113,639	9,739	103,900
1932.....	414,668	20,937	393,731	1945.....	149,221	9,509	139,712
1933.....	418,902	20,576	398,326	1946.....	¹ 390,267	7,711	382,556
1934.....	463,018	23,856	439,162	1947.....	711,513	4,121	707,392
1935.....	467,146	11,391	455,755	1948.....	735,340	6,672	728,668
1936.....	488,145	12,582	475,563	1949.....	660,551	6,253	654,298
1937.....	600,476	7,948	592,528	1950.....	802,138	8,640	793,498

¹ Includes 10,087 tons from Japan.

Table 28—TP 181 to 1937, Bureau of Census 1938-50.

Table VI, A(2).—UNITED STATES IMPORTS OF NATURAL RUBBER (INCLUDING LATEX AND GUAYULE)
FROM CHIEF SOURCES—1935-50

[1,000 long tons]

Year	Malaya	Indo-nesia	Thai-land	Cey-land	Indo-china	Other Asia & Oceania	Liberia	Other Africa	Mexico	Brazil	Other Tropical America	All Other	Total
1935..	345.7	78.0	.....	26.2	7.6	1.3	0.8	0.1	0.5	5.1	0.8	1.0	467.1
1936..	339.8	96.1	.....	27.0	13.2	1.3	1.6	0.2	1.2	4.0	1.0	2.7	488.1
1937..	384.8	153.2	.....	29.9	16.3	4.2	2.3	0.1	2.8	5.7	0.8	0.4	600.5
1938..	244.6	109.9	(*)	24.9	20.2	2.8	2.9	(*)	2.5	3.3	0.7	0.3	412.1
1939..	278.2	143.0	(*)	34.8	26.0	4.0	5.3	0.2	2.2	4.7	1.1	0.1	499.6
1940..	421.1	288.0	1.0	55.0	28.8	6.3	6.9	0.4	3.6	5.6	1.9	.....	818.6
1941..	552.1	369.4	0.9	61.0	21.9	2.4	7.3	3.3	4.9	4.6	1.4	.....	1,029.2
1942..	93.1	128.2	.....	34.1	.....	0.2	9.9	2.5	5.5	5.7	3.2	.....	282.4
1943..	(*)	0.4	.....	19.7	.....	.....	13.6	.....	7.7	12.6	5.9	.....	59.9
1944..	.....	.....	.....	58.8	.....	1.5	15.3	5.2	6.7	18.7	7.4	.....	113.6
1945..	7.7	0.3	.....	62.3	.....	5.1	20.3	16.2	10.0	19.0	8.3	.....	149.2
1946..	202.8	34.0	7.5	17.9	67.2	12.7	22.1	2.1	5.3	11.9	6.8	.....	390.3
1947..	571.0	36.3	11.8	40.5	9.7	2.2	20.5	1.9	2.9	9.9	4.8	.....	711.5
1948..	452.7	113.3	80.5	54.6	5.3	1.4	24.9	2.2	0.3	(*)	.....	0.1	735.3
1949..	311.1	179.2	98.2	41.8	1.9	1.0	25.7	1.4	.....	0.1	0.2	.....	660.6
1950..	360.8	214.0	106.1	63.4	20.8	1.3	28.9	4.7	0.7	0.3	0.6	0.5	802.1

* Less than .05.

Table VI, A(3).—U. S. IMPORTS OF NATURAL LATEX BY SOURCES, 1936-50

[Long tons]

Year	Malaya	Ceylon	Indonesia	Liberia	Indo-china	Other	Total
1936.....	9,421	4	9,347	709	.....	371	19,852
1937.....	9,183	20	12,807	1,137	.....	38	23,185
1938.....	4,976	85	5,551	1,317	.....	15	11,944
1939.....	11,508	39	13,510	2,318	45	18	27,438
1940.....	12,825	.....	16,923	4,039	.....	2	33,789
1941.....	12,775	.....	18,227	3,719	2	75	34,798
1942.....	1,850	1,255	2,194	5,261	.....	86	10,646
1943.....	11	.....	.....	1,879	.....	.....	1,890
1944.....	.....	.....	.....	3,091	.....	.....	3,091
1945.....	.....	.....	.....	4,773	.....	.....	4,773
1946.....	.....	.....	1,146	7,273	1	1	8,421
1947.....	9,765	72	(*)	7,672	33	.....	17,542
1948.....	25,102	109	423	7,110	.....	1	32,745
1949.....	22,154	156	633	6,800	.....	.....	29,743
1950.....	33,553	66	3,467	14,244	71	4	51,405

* Less than .05.

Source: U. S. Department of Commerce, Bureau of the Census.

Table VI, A(4).—U. S. IMPORTS OF TOTAL NATURAL RUBBER, AND NATURAL LATEX, BY PORTS OF ENTRY, 1946-50
[Percentages of total]

District	1946	1947	1948	1949	1950
	Natural rubber, dry and latex				
Massachusetts.....	5.0	11.2	6.0	7.7	8.2
New York.....	70.4	61.8	69.7	67.1	63.9
Philadelphia.....	2.8	1.4	0.2	0.4	0.3
Maryland.....	13.5	8.8	6.5	5.4	5.6
Virginia.....	2.2	3.8	0.3	2.5	0.2
Mobile.....	.....	0.4	2.7	1.6	2.9
New Orleans.....	0.2	4.5	6.3	6.2	6.3
Galveston.....	.....	.....	0.8	0.7	1.0
Laredo.....	1.4	0.4	(*)	.....	0.1
Los Angeles.....	1.4	4.2	6.2	7.7	11.1
San Francisco.....	0.7	0.3	0.2	0.3	0.3
Other.....	2.4	3.2	1.1	0.4	0.1
Total.....	100.0	100.0	100.0	100.0	100.0
District	Natural latex only				
	1946	1947	1948	1949	1950
Massachusetts.....	12.7	46.5	36.8	38.8	42.8
New York.....	35.2	24.7	34.2	29.6	30.3
Philadelphia.....	.....	0.1	0.2	0.2	(*)
Maryland.....	37.4	28.6	27.7	29.6	25.5
Virginia.....	10.5	.....	.....	.....	.....
New Orleans.....	.....	.....	.....	0.1	.....
Los Angeles.....	.....	(*)	0.8	1.4	1.3
San Francisco.....	4.2	.....	.....	.....	(*)
Other.....	.....	0.1	0.3	0.3	0.1
Total.....	100.0	100.0	100.0	100.0	100.0

* Less than 0.05 percent.

Source: U. S. Department of Commerce, Bureau of the Census.

Table VI, A(5).—UNITED STATES IMPORTS OF NATURAL RUBBER BY TYPES, 1948-50

Type	1948		1949		1950	
	Long tons	Percent	Long tons	Percent	Long tons	Percent
Natural Latex.....	32,630	4.4	29,974	4.5	51,405	6.4
Nos. 1X and 1 Ribbed Smoked Sheet...	164,267	22.3	178,206	27.0	157,815	19.6
Nos. 2, 3, 4, 5 Ribbed Smoked Sheet	300,922	41.0	222,363	33.7	255,761	31.9
No. 1 Thin & Thick Latex Crepe.....	12,576	1.7	17,474	2.6	19,831	2.5
Other Latex Crepes.....	13,279	1.8	12,932	2.0	18,926	2.4
Nos. 1X, 2X, 3X, 1, 2, 3, & 4 Thin Brown Crepes.....	51,641	7.0	56,900	8.6	95,307	11.9
Nos. 2, 3, 4 Blanket (Amber) Crepe, & 1, 2 Smoked Blanket Crepe.....	135,180	18.4	114,178	17.3	163,922	20.4
Flat Bark & Miscellaneous.....	24,845	3.4	28,524	4.3	39,171	4.9
Total.....	735,340	100.0	660,551	100.0	802,138	100.0

Source: Rubber Manufacturers Association, Inc.

B. SYNTHETIC RUBBER

Russia does not export synthetic rubber to countries other than Russian satellite nations, and although U. S. Government efforts to import tiny samples of some Russian-produced synthetics before World War II were successful, no imports since the war are known.

In 1939, a small tonnage of Buna N rubber from Germany was imported, but none subsequently.

Imports from Canada of butadiene-styrene rubber, both dry and latex, have been substantial since 1944. A noteworthy tonnage of Canadian butyl has also been imported. In this trade, the Canadian Government uses a New York rubber dealer as distributor-agent. By selling their surplus output in the United States at a price slightly below the fixed prices charged by the United States Government for similar types, they have been able to maintain a high rate of output in Canada, spreading their overhead costs more thinly over a greater volume of business. Negligible amounts of these imported synthetics have been re-exported.

Table VI, B(1).—U. S. IMPORTS OF SYNTHETIC RUBBER FROM CANADA, 1943-50

[Long tons]

Year	S-Type			Butyl	Grand total
	Dry	Latex	Total		
1943..	0	0	0	0	0
1944..	9,681	0	0	1,362	11,043
1945..	5,455	0	0	4,952	10,407
1946..	0	0	0	7,709	7,709
1947..	1,089	0	0	4	1,093
1948..	11,136	476	11,612	4,059	15,671
1949..	13,779	1,654	15,433	1,809	17,242
1950..	17,815	2,824	20,639	5,083	25,722

Source: U. S. Department of Commerce, Bureau of the Census.

Exports of domestically-produced general purpose synthetic rubber from the United States were of great importance in 1944, 1945, and 1946, while supplies of natural rubber continued scanty, but since then exports have been confined chiefly to Neoprene and N-types for which about 10 percent of the sales have been to foreign markets. During 1950 and 1951 very small amounts of GR-S and Butyl have been exported to foreign countries—the domestic demand for Butyl constantly exceeded the supply and except at the end of 1951, this was also the situation with respect to GR-S.

The exports of GR-S during and immediately after World War II went chiefly to our principal European allies, the United Kingdom and France, which accounted for about 70 percent of these exports in 1943-46. Other countries which received quantities sufficient to give them considerable wartime experience in its use include Australia, South Africa, Argentina, Brazil, Cuba, Mexico, Belgium, Italy, Spain, Sweden, Russia, and Canada. The small Butyl exports went mostly to the United Kingdom and some Latin American countries. The United Kingdom, Canada, and France have been the chief buyers of Neoprene and N-Type rubbers.

Table VI, B(2).—U. S. EXPORTS OF SYNTHETIC RUBBER, 1941-50

[Long tons]

Year	GR-S	Butyl	Neoprene	N-Type	Total
1941..	0	0	572	0	572
1942..	222	0	1,037	160	1,459
1943..	14,937	40	2,540	631	18,108
1944..	98,380	530	4,799	557	104,266
1945..	76,555	980	5,837	406	83,778
1946..	69,076	496	2,642	797	73,011
1947..	7,951	63	2,619	756	11,389
1948..	1,094	17	2,870	883	4,864
1949..	1,401	177	3,330	1,574	6,482
1950..	901	32	4,827	1,893	7,653

Source: Rubber Division, NPA and Bureau of the Census.

C. RECLAIMED RUBBER

Imports of reclaimed rubber ordinarily are negligible. Usually such imports consist of small across-the-border shipments from Canada. In 1950 and the first half of 1951 there were also small imports of reclaim from the United Kingdom. None of these imports are re-exported.

Exports of domestically-produced reclaim average around 1,000 long tons monthly, going mostly to Canadian manufacturers of rubber goods. During the war, unusually large exports were made only in 1942, largely to the United Kingdom before the expansion of reclaiming facilities there.

Table VI, C(1).—U. S. IMPORTS AND EXPORTS OF RECLAIMED RUBBER

[Long tons]

Year	Imports	Exports
1941.....	0	13,852
1942.....	893	30,406
1943.....	67	15,717
1944.....	25	11,979
1945.....	0	13,013
1946.....	40	14,461
1947.....	18	14,555
1948.....	10	11,428
1949.....	25	10,367
1950.....	1,059	11,741

Source: Bureau of the Census.

VII

Imports, Exports, and Reexports, Significant Foreign Countries

VII

Imports, Exports, and Reexports, Significant Foreign Countries

A. NATURAL RUBBER

Most of the rubber produced in the countries of the Far East is exported directly to consuming countries in North America and Europe, with much smaller quantities to Asia, Latin America, Africa, and Australia. A considerable portion of the rubber produced in Indonesia, Sarawak and British North Borneo customarily reaches world markets through Singapore and other Malayan ports. The Malayan statistics, however, do not show destinations of re-exported rubber separately from the exports of domestically produced rubber. The volume and sources of the Malayan imports in 1949 and 1950 were as follows:

MALAYAN IMPORTS OF NATURAL RUBBER, 1949-50

[Long tons]

Country	1949	1950	Country	1949	1950
Indonesia:					
Rhio.....	8,517	12,260	Sarawak.....	30,948	47,332
Bangka and Billiton...	4,954	10,649	North Borneo.....	13,342	15,876
Borneo.....	14,961	57,483	Thailand.....	17,030	10,269
Java.....	3,820	28,919	Burma.....	6,051	7,850
Sumatra and other....	114,720	252,276	Other Asia.....	5,798	5,742
Total.....	146,972	361,587	Total.....	220,141	448,656

The rubber produced in Latin America is nearly all consumed in that area. The rubber produced in Africa is practically all exported, from Liberia direct to the United States, from other countries to the United Kingdom, France, Belgium, Germany, and the United States.

Traditionally, the movement of rubber from Southeast Asia to the American and European markets is westward, through the Suez Canal and the Mediterranean. This direction of shipments aided European shipping and banking interests and strengthened the British and Dutch position in the world trade in rubber. This traffic was interrupted after Mussolini's conquest of Ethiopia, and much of the rubber shipped to Europe went around the Cape of Good Hope, while shipments to the United States went increasingly across the Pacific and through the Panama Canal to our Atlantic ports; entries into our Pacific ports also increased. Previous to this time, United States purchases from secondary rubber markets in Europe (London, Liverpool, Amsterdam, Rotterdam) had been fairly important, but while contracts are still often made through those markets, the rubber we import is now usually shipped direct from the Far East to the United States.

The statistics with respect to imports and re-exports of rubber for certain European countries are often not very revealing with respect to the tonnage of rubber actually handled. Such statistics may, or may not, include transit trade, or trade through Free Ports. However, the quantity of rubber that actually passes in and out of such ports as London, Liverpool, Amsterdam, Hamburg, and Brussels, en route to other European countries, while important in their trade, is not of particular concern to the United States under normal circumstances. Only when we are interested in determining how much rubber is reaching a certain destination which conceals its imports, as in the case of Germany before World War II, or in the case of Russia today, is this a matter of much concern to us.

Another factor which adds to the difficulty of tracing the movement of rubber is the fairly common, and commercially convenient, practice of shipping rubber from the Far East under an open bill of lading on a ship bound for European and United

States ports. The shipper may elect to land the rubber at any port where he finds a buyer while the ship is en route. While the rubber may be recorded in statistics of the country of export as destined for the United Kingdom, it may be unloaded actually at ports either on the Continent of Europe or in the United States. In a period of rising market prices, an increasing percentage of the shipments from the Far East are likely to remain unsold until they are near ports of arrival.

In recent years there has been an increasing volume of shipments northward from Southeast Asia to China (or to Russia via China), in addition to the regular movement to Japan, China, Hong Kong, and Korea. Certain Latin American countries once obtained Far Eastern rubber by purchase and re-export from the United States and the United Kingdom, but now import directly from the Far East. Australia and South Africa receive their supplies direct from the Far East.

Table VII, A(1) shows the new supply or net imports (gross imports, less re-exports if reported) of countries which in recent years are taking 5,000 long tons or more natural rubber (dry and latex) in any year. Statistics for the war years 1941-45 are faulty and have been omitted. In connection with this table, remember that the Far Eastern production of rubber in 1936-40 was restricted, under terms of the International Rubber Regulation Agreement, far below the then capacity of production which was around 1,600,000 tons a year. The severity of restriction was less in 1937 and 1940 than in the other years. The net imports into the United States exceeded 800,000 long tons only in 1940 and 1941, when shipments to the Continent of Europe were almost terminated by the war, and restrictions on production were being reduced. The 1936 clearance of stocks accumulated in the United Kingdom resulted in an excess of 1936 exports over imports for that country. In 1946, the shipment of rubber stocks found in Japan to the United States caused a similar result.

In Table VII, A(2) the estimated imports of natural latex into principal consuming countries are separately shown for years 1946-50.

One European country for which statistics of in-transit trade in rubber have been published is the Netherlands. Part of the rubber is actually handled in Dutch ports, but in many cases it remains on the ships of arrival and is reconsigned to other countries with mere document records of the in-transit transaction, it is believed. Statistics showing the destinations of the important in-transit rubber trade through the Netherlands are shown for years 1947-50 in Table VII, A(3). Much of this rubber was imported from Indonesia, which at that time was a colony of the Netherlands. This volume of in-transit trade declined in 1950, when Indonesia was granted her independence.

The United Kingdom has a larger re-export trade in natural rubber than any other consuming country. Table VII, A(4) shows the British re-exports for 1946-50. During 1946, the British Government made large imports from Malaya until British stocks became unwieldy, when they sold some 80,000 tons to the United States Government, resulting in the heavy re-exports in 1947 to the United States. At various times the re-exports to Russia have been fairly important.

Table VII, A(1).—ESTIMATED NEW SUPPLY OF NATURAL RUBBER, PRINCIPAL COUNTRIES 1936-40 and 1946-50

[1,000 long tons]

Country	1936	1937	1938	1939	1940	1946	1947	1948	1949	1950
Austria.....	3.4	3.8	7.8	1.1	(¹)	0.5	1.5	3.8	8.2	7.3
Belgium.....	9.6	15.0	11.3	9.6	3.0	4.7	13.8	12.7	11.7	12.1
Czechoslovakia.....	8.8	13.1	9.9	5.0	(¹)	0.8	14.8	23.4	27.5	22.5
Denmark.....	3.2	2.6	2.9	2.9	1.6	2.0	3.2	5.2	5.1	5.6
France.....	57.0	59.1	58.1	64.4	30.0	56.6	64.0	84.0	90.3	95.5
Germany.....	71.8	98.2	90.2	75.0	17.0	2.0	12.5	48.9	83.4	90.5
Hungary.....	2.8	3.4	3.1	2.6	2.7	0.3	2.4	3.0	8.5	6.5
Italy.....	16.5	24.0	28.2	18.0	20.7	10.3	28.2	28.1	29.2	36.8
Netherlands.....	2.9	4.3	5.1	7.1	1.1	1.7	9.9	13.7	10.9	12.7
Poland.....	4.8	6.1	7.8	6.0	(¹)	1.4	2.3	3.6	12.0	5.5
Spain.....	6.7	2.4	2.4	3.6	3.2	2.1	10.2	6.5	7.4	6.3
Sweden.....	4.6	6.7	8.3	9.3	3.0	5.9	15.2	14.3	21.6	13.9
Switzerland.....	1.8	2.4	2.6	2.5	2.2	1.9	4.3	5.3	4.3	4.9
United Kingdom.....	(7.4)	91.0	132.0	69.2	199.4	234.8	110.0	187.0	155.3	222.2
U.S.S.R.....	31.0	30.5	26.8	30.0	20.0	9.5	35.0	100.0	105.0	82.5
Other Europe.....	9.8	14.9	14.8	8.8	9.1	4.3	14.1	18.0	21.2	22.4
Union of South Africa.....	4.1	6.2	5.5	9.8	9.1	12.1	13.0	16.3	17.2	21.1
Argentina.....	5.6	9.5	7.7	9.6	9.1	4.9	28.4	1.7	7.2	17.5
Brazil.....	2.3	2.8	3.1	5.4	7.0	14.8	17.0	20.0	24.0	24.0
Canada.....	27.9	36.1	25.7	32.5	52.6	11.7	34.6	42.7	40.0	46.3
Mexico.....	2.7	4.2	2.9	5.1	3.4	5.0	7.7	11.4	10.0	11.1
British Malaya.....	0.4	0.6	0.5	0.5	1.4	1.0	3.2	6.2	6.9	9.0
China.....	8.0	5.3	2.8	4.6	5.5	12.1	22.2	21.0	27.5	70.0
Hong Kong.....	1.5	1.2	1.2	2.2	2.3	1.7	9.3	0.5	1.5	0.2
India.....	5.7	7.2	5.7	7.0	11.0	15.3	16.4	18.4	18.3	15.6
Indonesia.....	1.3	2.0	2.3	3.2	3.7	0.5	1.0	3.1	9.1	8.7
Japan.....	61.7	62.2	46.3	42.4	40.7	(10.1)	14.7	29.9	41.4	58.8
Australia.....	14.4	19.3	12.3	15.4	19.0	17.0	23.6	28.7	22.7	35.9
All others.....	9.0	13.4	11.3	10.7	10.6	6.4	13.2	23.9	28.3	33.5
Total Foreign.....	374.4	547.5	538.6	463.5	488.4	431.2	545.7	781.3	855.7	998.9
United States.....	475.6	592.5	406.4	486.5	811.6	396.3	684.3	728.7	654.3	793.6
Grand total.....	847.5	1,140.0	945.0	950.0	1,300.0	827.5	1,230.0	1,510.0	1,510.0	1,792.5

¹ Included in Germany.

Note: For most countries figures represent net imports, but for producing countries such as Brazil, British Malaya, India, and Indonesia they approximate domestic consumption. Statistics for postwar Germany are for Western Germany only. Figures in parentheses are minus figures, indicating excess of re-exports over imports.

Source: Rubber Statistical Bulletin, Secretariat of the International Rubber Study Group.

Table VII, A(2).—ESTIMATED NET IMPORTS OF NATURAL LATEX, PRINCIPAL COUNTRIES 1946-50

[In long tons]

Country	1946	1947	1948	1949	1950
United Kingdom.....	2,480	8,144	9,835	11,112	15,905
Germany.....	0	284	1,118	1,892	4,000
France.....	0	1,043	2,732	2,696	4,702
Italy.....	0	710	903	775	1,310
Netherlands.....	33	312	408	594	894
Australia.....	79	600	1,129	1,076	1,733
Canada.....	214	1,109	1,667	2,230	3,615
Other Foreign.....	327	2,831	2,463	4,382	5,936
Total Foreign.....	3,133	15,033	20,255	24,757	38,095
United States.....	7,867	17,467	32,745	29,743	51,405
Grand total.....	11,000	32,500	53,000	54,500	89,500

Source: Secretariat of the International Rubber Study Group.

Table VII, A(3).—NETHERLANDS IN-TRANSIT SHIPMENTS—CHIEF DESTINATIONS—1947-50

[In long tons]

Country	1947	1948	1949	1950	Country	1947	1948	1949	1950
United States.....	1,661	33,394	89,974	38,842	Poland.....	.....	724	978	1,278
United Kingdom....	3,450	7,334	2,946	11,126	Portugal.....	.....	134	506	562
Austria.....	729	727	2,027	2,872	Spain.....	.....	188	24	684
Belgium.....	1,746	3,536	3,917	6,304	Sweden.....	.....	1,174	5,476	1,947
Bulgaria.....	.....	.....	246	78	Switzerland.....	3,618	4,350	4,072	5,228
Czechoslovakia....	8,196	3,329	8,521	1,770	U. S. S. R.....	.....	.....	21,540	4,501
Denmark.....	.....	265	131	380	Yugoslavia.....	.....	.....	610	2,781
Finland.....	.....	343	187	642	Mexico.....	.....	.....	151	379
France.....	356	5,187	4,545	7,084	Venezuela.....	.....	5	51	460
Germany.....	2,481	15,838	20,634	25,150	Palestine.....	.....	.....	96	.....
Hungary.....	.....	1,681	4,476	2,145	Others.....	2,333	265	226	721
Italy.....	.....	1,515	1,613	1,671	Total.....	24,570	80,955	173,712	117,029
Norway.....	.....	966	765	424					

Source: Secretariat of the International Rubber Study Group.

Table VII, A(4).—UNITED KINGDOM RE-EXPORTS OF NATURAL RUBBER 1946-50

[In long tons]

Destination	1946	1947	1948	1949	1950
United States.....	7,277	74,900	18,048	12,672	6,237
Austria.....	.....	447	288	705	183
Belgium.....	119	490	482	617	520
Bulgaria.....	.....	.....	.....	401	453
Czechoslovakia.....	1,274	1,734	5,810	3,917	1,122
Denmark.....	1,141	44	267	197	246
Eire.....	1,240	1,896	2,496	2,578	3,327
Finland.....	368	30	287	213	71
France.....	2,907	176	364	580	1,604
Germany.....	1,941	6,238	3,722	2,918	2,160
Greece.....	89	969	13	51	57
Hungary.....	190	795	332	275	140
Italy.....	10,876	10,938	338	626	633
Netherlands.....	1,441	145	62	144	302
Norway.....	809	90	127	301	360
Poland.....	884	551	320	149	193
Portugal.....	480	151	289	107	141
Rumania.....	.....	14	.....	18	93
Spain.....	2,742	117	771	237	278
Sweden.....	3,033	805	747	289	480
Switzerland.....	1,917	337	411	574	325
Turkey.....	130	91	46	45	65
U. S. S. R.....	205	6,022	404	482	10,075
Yugoslavia.....	1,880	500	591	828	353
Argentina.....	1,500	197	13	464	895
Canada.....	2,469	18	105	274	363
Chile.....	260	235	26	65	48
Mexico.....	950	15	.....	50	21
Uruguay.....	340	9	15	39	55
Venezuela.....	.....	.....	16	32	94
Morocco.....	.....	.....	168	258	.....
Union of South Africa.....	84	55	4	3	10
China.....	.....	.....	.....	800	.....
Israel.....	.....	.....	.....	.....	251
Palestine.....	26	18	81	185	15
Australia.....	161	71	5	.....	6
Others.....	881	45	132	41	87
Total.....	47,614	108,143	36,780	31,135	31,263

Source: Secretariat of the International Rubber Study Group.

B. SYNTHETIC RUBBER

Few countries publish records of imports or exports of synthetic rubber. However, records of its estimated consumption are available for the principal foreign countries which have used it during and since World War II, except Russia. These consumption statistics as shown below reflect imports, except in the cases of Canada and Germany, where domestically-produced synthetics were used. The imports into Continental European countries in 1941-44 were from Germany; for subsequent years chiefly from U. S. and Canada.

ESTIMATED FOREIGN CONSUMPTION OF SYNTHETIC RUBBER, 1940-50

[In 1,000 long tons]

Year	United Kingdom	France	Germany	Other Europe	Canada	Australia	Other countries	Total
1940.....	0	0	40.0	0	0	0	0	40.0
1941.....	0	0	50.5	15.3	0	0	0	65.8
1942.....	0	6.1	69.0	20.8	0	0	0	95.9
1943.....	3.3	10.2	88.5	16.2	3.7	0	0.3	122.2
1944.....	41.8	5.4	80.0	14.0	24.7	0.1	5.0	171.0
1945.....	63.8	17.4	22.5	16.0	35.9	4.8	12.6	173.0
1946.....	30.1	28.7	11.9	34.4	29.6	4.4	11.9	151.0
1947.....	2.8	12.6	7.9	12.8	29.2	0.2	1.2	66.7
1948.....	2.6	7.4	4.4	3.6	20.6	0.2	0.6	39.4
1949.....	2.4	8.3	2.2	3.5	18.1	0.2	0.5	35.2
1950.....	2.8	7.4	3.4	5.3	22.6	0.2	0.4	42.1

Source: Statistical Bulletin, Secretariat of International Rubber Study Group.

C. RECLAIMED RUBBER

The international trade in reclaimed rubber is unimportant. Canada imports most of the reclaim exported from the United States. The United Kingdom exports regularly to some of the British possessions and small amounts to Europe. French and German manufacturers of reclaimed rubber make small shipments to other European countries. The following statement shows the Canadian annual imports and the British annual exports of reclaim for recent years.

[In long tons]

Year	Canadian imports of reclaim	British exports of reclaim
1945.....	10,187	1,151
1946.....	10,142	756
1947.....	10,749	1,434
1948.....	9,797	2,147
1949.....	8,968	3,153
1950.....	9,774	5,164

Source: Official Canadian and British statistics of foreign trade.

VIII

World Stocks of Rubber



VIII

World Stocks of Rubber

A. NATURAL RUBBER

High grade plantation rubber in dry forms, properly packed and warehoused under good conditions of cool temperature, mild humidity, and freedom from sunlight will deteriorate very little in a period of several years. In 1925, rubber that had been stored in London warehouses since 1921 was in excellent condition, and some of the best smoked sheet rubber in the United States strategic stockpile in 1951 was acquired before the end of 1941. Long storage of natural latex is not recommended, although anti-coagulants and periodic agitation make it storable for extensive periods.

Stocks of natural rubber should be thought of in three groups: (1) stocks in producing countries; (2) stocks afloat at sea; and (3) stocks in consuming countries, with Government strategic stocks as a subdivision.

Producers seldom maintain facilities for warehousing large stocks of natural rubber. Ordinarily the estate holdings represent mere working stocks—varying from two to four weeks production. In producing countries, stock accumulations usually occur mainly in holdings by traders and exporters at trading centers and ports, and chiefly in Malaya. Sometimes a lack of shipping space will result in temporary accumulations at ports. Normally, the stocks of rubber in hands of producers and dealers in all producing countries have averaged less than two months production; larger quantities reflected unusual conditions such as anticipation of reduced export taxes, lack of shipping, etc. A general change merely from eight weeks to seven weeks holdings in a month, however, would mean about 40,000 tons less of rubber shipments for the month at the recent rate of production. Table VIII, A(1) shows statistics of world stocks in producing countries at the end of each year from 1946 to 1950 as estimated by the Secretariat of the International Rubber Study Group. It should be noted that reported statistics are available for only Malaya, Ceylon, and Indochina.

Table VIII, A(1).—ESTIMATED YEAR-END STOCKS OF NATURAL RUBBER IN PRODUCING COUNTRIES, 1946-50
[In 1,000 long tons]

Country	1946	1947	1948	1949	1950
Malaya:					
Estates.....	18.7	21.9	24.6	22.0	15.4
Dealers.....	107.6	93.0	89.3	82.1	86.8
Port Stocks.....	22.8	25.5	24.8	19.2	34.3
Indonesia:					
Estates.....	.....	.....	13.3	13.0	15.1
Other (estimated).....	35.0	40.0	¹ 24.2	¹ 34.5	¹ 39.9
Ceylon:					
Estates.....	4.7	7.6	11.6	10.2	7.7
Dealers.....	6.1	9.7	8.9	9.1	6.4
Vietnam and Cambodia:					
Estates.....	4.5	5.5	5.9	5.7	4.7
Dealers.....	18.7	6.0	7.3	9.3	4.6
Belem and Manaos.....	7.0	6.6	9.2	10.8	4.2
All other (estimated).....	12.4	14.2	15.9	21.6	25.9
Total.....	237.5	230.0	235.0	237.5	245.0

¹ These estimates are probably conservative (Holt).

Source: Secretariat of International Rubber Study Group.

During World War II, Indochina was the only Far Eastern country cut off from world markets which continued to produce rubber on a large scale in anticipation of the post-war demand. At the end of 1944, there was some 165,000 tons of rubber in that country ready for marketing; most of this was exported before the end of 1946.

The stocks of rubber afloat at sea are not reported and tabulated. The month-end tonnage is estimated by the Secretariat of the Rubber Study Group, since 1945, by calculations based upon the difference between world exports and world net imports. About two months shipments were thus estimated afloat at the end of 1946, 1947, and 1948, but in 1949 and 1950 the year-end figures declined to an average of 1.75 months, and in the first eight months of 1951 the average month-end tonnages was 1.69 months shipments.

ESTIMATED NATURAL RUBBER AFLOAT, YEAR-END

End of—	1,000 long tons	Months' shipments
1946.....	210.0	2.0
1947.....	240.0	2.0
1948.....	235.0	2.0
1949.....	227.5	1.7
1950.....	275.0	1.8
1951(August).....	245.0	1.9

The tonnage of rubber afloat tends to rise and fall with the rate of rubber production and shipments, but is also affected by the changing destinations. Many shipments to the United States are afloat for two months or more, shipments to Europe may average only one month in transit, shipments to Japan, China, and Australia only three weeks. As foreign countries take an increasing percentage of world production, the tonnage afloat tends therefore to diminish.

The stocks of natural rubber in foreign consuming countries are in several cases reported monthly, but for most small countries the statistics are not collected and the only data available are estimates by the Secretariat of the International Rubber Study Group. Their statistics are shown in Table VIII, A(2). Under the United Kingdom, warehouse stocks represent mainly holdings by rubber traders, and Government stocks since 1947 are estimates by the NPA Rubber Division. Under France, the Government stocks are likewise estimated by the writer, on the basis of net imports and consumption adjusted for variations in the reported industry stocks, the unaccounted-for balance being entered as Government stocks.

Table VIII, A(2).—ESTIMATED STOCKS OF NATURAL RUBBER IN FOREIGN CONSUMING COUNTRIES, 1940-50

[In 1,000 long tons]

Year	United Kingdom			France		Germany	Australia	Brazil ²	Canada	India ³	Others	Total
	Manufacturers	Warehouse	Government	Industry	Government							
1940..	20.3	35.4	40.6	5.6	.....	9.0	5.0	(¹)	20.0	5.7	45.0	186.6
1941..	33.0	5.1	59.6	.....	.....	3.5	7.5	(¹)	32.5	7.3	70.0	218.5
1942..	17.6	.....	42.7	0.7	.....	2.5	11.6	(¹)	22.3	9.0	100.0	206.4
1943..	14.8	.....	45.4	.....	.....	5.5	10.2	(¹)	8.2	15.0	140.0	239.1
1944..	10.3	.....	37.1	0.1	.....	2.5	4.4	(¹)	5.4	11.7	95.0	166.5
1945..	7.8	.....	44.7	0.8	.....	1.0	3.3	(¹)	3.7	9.1	45.0	115.4
1946..	17.0	.....	164.0	27.6	.....	0.8	4.7	(¹)	5.9	10.3	25.0	255.3
1947..	27.0	9.2	91.0	30.5	.....	1.8	4.6	2.5	5.3	9.0	62.5	243.4
1948..	31.2	19.2	⁴ 69.9	28.1	.....	2.8	7.0	4.4	5.8	7.7	47.5	223.6
1949..	23.8	15.4	⁴ 52.3	13.7	⁴ 13.5	13.3	3.2	4.1	5.2	8.4	57.5	210.4
1950..	25.9	12.3	⁴ 55.9	10.1	⁴ 12.7	11.7	5.5	1.0	3.4	6.3	80.0	224.8

¹ Not available.

² Stocks in Southern Brazil consuming areas.

³ Excluding producers stocks.

⁴ Calculated by NPA Rubber Division from imports, consumption, reexports, and reported stocks.

Source: Based on Reports of Secretariat of International Rubber Study Group.

Stocks of natural rubber in the United States, until 1939, were entirely in the hands of (1) manufacturers, and (2) merchant importers and dealers. Since 1939, the United States Government has, in addition, held large stocks for strategic purposes. Table VIII, A(3) shows the year-end industry and trade stocks since 1921, and their total in terms of months' supply based on consumption of natural rubber (dry and latex) during each year.

Table VIII, A(3).—ESTIMATED STOCKS OF NATURAL RUBBER IN THE UNITED STATES, 1921-50

[Long tons]

End of—	Manu- facturers	Importers and dealers	Total	Months' supply ¹	End of—	Manu- facturers	Importers and dealers	Total	Months' supply ¹
1921.....	n. a.	n. a.	99,758	6.73	1936.....	156,673	66,327	223,000	4.65
1922.....	n. a.	n. a.	94,653	3.77	1937.....	167,300	94,900	262,200	5.79
1923.....	n. a.	n. a.	76,758	2.88	1938.....	134,700	96,800	231,500	6.36
1924.....	n. a.	n. a.	57,717	2.11	1939.....	90,500	35,300	125,800	2.55
1925.....	41,553	9,662	51,215	1.58	1940.....	142,904	33,466	176,370	3.26
1926.....	61,887	10,623	72,510	2.38	1941.....	n. a.	n. a.	145,366	2.25
1927.....	80,095	19,187	99,282	3.19	1942.....	n. a.	n. a.	74,530	2.37
1928.....	50,524	14,930	65,454	1.80	1943.....	n. a.	n. a.	34,500	1.30
1929.....	68,327	50,282	118,609	3.05	1944.....	n. a.	n. a.	17,668	1.47
1930.....	137,500	63,500	201,000	6.41	1945.....	n. a.	n. a.	19,701	2.24
1931.....	214,147	107,853	322,000	10.88	1946.....	n. a.	n. a.	69,073	2.99
1932.....	309,000	70,000	379,000	13.51	1947.....	102,115	26,923	129,038	2.75
1933.....	251,000	114,000	365,000	10.62	1948.....	107,867	33,674	141,541	2.71
1934.....	243,456	111,544	355,000	9.21	1949.....	76,032	30,587	106,619	2.23
1935.....	180,295	122,705	303,000	7.40	1950.....	56,932	32,283	89,215	1.40

¹Months' supply calculated on the basis of natural rubber consumed in the same year.

n. a. Not available.

Note: Statistics include all forms of natural rubber, dry and latex.

Source: NPA Rubber Division and predecessor agencies.

The practice of industry and trade in respect to holding stocks of rubber has been greatly influenced by Government activities in the natural rubber business. In 1921, inventories everywhere were high (in terms of months' supply). The Stevenson (British) Restriction Scheme (1922-28) retarded production of natural rubber until stocks were dangerously reduced by the end of 1924. Soaring prices in 1925 led to higher production and some rebuilding of stocks through 1927. The release of the control in 1928 led to higher production, and stocks thereafter accumulated heavily as demand was retarded during the depression of 1929-33. The International Rubber Regulation Scheme in 1934-39 followed a similar pattern, forcing stock reductions through 1936, with some rebuilding in 1937-38, then renewed severe restriction which again forced stock reductions through 1939, when the U. S. Government entered the picture through the cotton-rubber barter deal.

In the 1922-28 period, manufacturers learned first the danger of allowing stocks to become too short, and second the danger of holding high stocks when control ended in 1928 leaving the American rubber pool with severe losses upon liquidation of their holdings. In the first part of the 1934-40 period they applied the first lesson, but since Government entry into the equation as a matter of strategic necessity from the standpoint of national defense the manufacturers have never carried long stocks. Importers and dealers likewise liquidated all their excess holdings in the course of the two restriction periods, and since 1939 have held mere trading stocks with which to service their customers. Inter-trading between dealers helps each to supply the grades and qualities required by their orders from the manufacturers.

In September, 1939, the U. S. Government through the Commodity Credit Corporation, bartered 500,000 bales of cotton for 90,500 tons (final figure) of rubber.

Since then, continuously to date, our Government has been a large holder of rubber stocks, and industry has in effect considered the provision of sufficient stocks for an emergency to be purely a Government function, to be supported by the general taxpayer. The practice of reduced private holdings relieves the industry of a financial burden, and in times when they are caught short and have to pay high prices, they as a rule are able to charge higher prices for their products.

In 1940, the Reconstruction Finance Corporation was assigned the task of building a strategic stockpile of natural rubber. Natural rubber production being under the control of foreign Governments, Government-to-Government deals were made with the British Government as a result of which our imports were greatly increased up to the time of the Pearl Harbor attack. The RFC and Commodity Credit stocks were merged. The industry inventories were by agreement expected to be maintained at 150,000 tons until we entered the war; thereafter they were controlled by Government regulations until 1947. As the threat of American involvement in the war increased, full jurisdiction over all imports of natural rubber was placed in RFC, which bought mainly through manufacturers until the United States entered the war, then through the Rubber Development Corporation until April 1, 1947, when private importation was again permitted.

Throughout World War II, RFC distributed natural rubber in accordance with instructions from the War Production Board and the Office of the Rubber Director, which successively held the directive authority. By the end of 1944 the large stocks on hand in 1941 had been used with the exception of a near minimum working residual. In late 1946, the Rubber Development Corporation purchased some 80,000 tons of rubber from large stocks accumulated that year by the British Government, and their delivery in early 1947 coincided with the freeing of U. S. imports to private interests.

It is worthy of note that the buying price for No. 1 Ribbed Smoked Sheet established by the Rubber Development Corporation in purchasing from Far Eastern sources while they remained under Allied military occupation after the war, and in purchasing from the British Government in 1946, was about 22 1/2 cent per pound. The American negotiators were men of experience in rubber trading and were willing to pay a fair and reasonable but not exorbitant price. They did not believe that the American public should bear the costs for rubber estate rehabilitation. The fact that the price was agreed to by the British, even though reluctantly, is evidence that in terms of money values at that time, the 22 1/2 cent price yielded a substantial profit over the costs of production and handling to point of delivery. The average New York free market prices of 20.8 cents for 1947, 22.0 cents for 1948, and 17.6 cents for 1949 are similarly evidential.

B. SYNTHETIC RUBBER

The stocks of synthetic rubber outside the United States at present are negligible except in Canada; they were substantial but not particularly significant during and immediately after World War II. Table VIII, B(1) shows estimated stocks for Germany during the period when the German synthetic rubber industry was active, and reported stocks for other foreign countries as assembled by the Secretariat of the International Rubber Study Group. In 1950, because of the high price of natural rubber, the available supplies of synthetic were in demand, and foreign stocks at the year-end were reduced to a low point.

United states stocks of synthetic rubber are shown in Table VIII, B(2), by types of rubber. The build-up in stocks as production mounted through 1945, and the decline in 1946 and subsequently as natural rubber became available and production of synthetics declined is clearly reflected. At the end of 1947, our stocks of synthetic rubber were reduced too much in anticipation of greater imports and usage of natural rubber than actually occurred, and again in 1950 the stocks were reduced to a dangerously low point by unexpectedly high demand. They have been restored in 1951 to a satisfactory working level at the current rate of consumption. Total stocks averaged 3.17 months' supply in the 1941-45 period, and 2.06 months' supply in the 1946-50 period; the latter would appear to be near a desirable working ratio under normal circumstances.

Table VIII, B(1).—ESTIMATED STOCKS OF SYNTHETIC RUBBER OUTSIDE THE UNITED STATES, 1940-50

[Long tons]

End of—	United Kingdom	France	Germany	Australia	Canada	South Africa	Total
1940.....	0	0	10,000	0	0	0	10,000
1941.....	0	388	20,000	0	0	0	20,388
1942.....	0	1,727	22,500	0	0	0	24,227
1943.....	7,333	1,184	20,000	67	2,292	0	30,876
1944.....	55,020	276	20,000	1,126	3,641	16	80,079
1945.....	17,156	2,613	3,105	1,164	4,107	2,974	31,119
1946.....	3,421	5,817	3,948	241	4,565	274	18,266
1947.....	2,026	6,489	832	253	4,200	134	13,934
1948.....	1,956	3,197	515	169	4,336	0	10,173
1949.....	1,117	2,709	1,583	231	4,442	0	10,082
1950.....	784	1,860	848	146	3,015	0	6,653

Source: Rubber Statistical Bulletin, Rubber Study Group.

Table VIII, B(2).—STOCKS OF SYNTHETIC RUBBER IN THE UNITED STATES, 1941-50

[Long tons]

End of—	S-Type	Butyl	Neoprene	N-Type	Total	Months' supply
1941.....	130	3	700	869	1,702	3.26
1942.....	1,050	4	1,786	1,772	4,612	3.14
1943.....	30,975	1,033	6,415	3,145	41,568	2.92
1944.....	116,130	9,892	11,739	5,166	142,927	3.03
1945.....	170,571	18,378	9,703	4,802	203,454	3.52
1946.....	81,483	19,478	10,470	3,755	115,186	1.81
1947.....	40,606	13,184	5,237	3,339	62,366	1.34
1948.....	96,282	10,995	5,072	2,762	115,111	3.12
1949.....	77,731	12,224	4,654	3,433	98,042	2.84
1950—June.....	47,987	8,793	5,232	3,334	65,346	1.81
1950.....	36,942	7,243	5,733	2,840	52,758	1.13
1951—June.....	60,259	8,071	6,476	3,349	78,154	1.41
October (preliminary).....	90,112	9,109	7,878	4,116	111,215	1.82

Table VIII, B(3) shows the stocks of general purpose rubber (S-Type) divided between the Government and the industry at quarterly intervals for the post-war period. Only once has the industry carried large stocks, in terms of months' supply; that was at the end of 1946 and early 1947 in preparation for the end of Government buying and distributing imported natural rubber. In fact, it could be argued that they have taken large risks by their practice of carrying low stocks, and certainly an "insurance" policy of carrying high stocks in 1949 would have done something to retard the decline in production which then occurred, and would have left them better fortified to meet the tremendous demand for rubber products in 1950-51, without bringing so much pressure on the market for natural rubber and pushing its price so high. On the other hand, the steady price of GR-S during the post-war years and the fact that manufacturers always, even in 1947, had been able to obtain all of this material they really needed, with the economy in saving of warehouse and handling costs, had encouraged the practice of getting along with minimum stocks.

Table VIII, B(3).—U. S. STOCKS OF S-TYPE RUBBER, GOVERNMENT AND INDUSTRY

	Government			Industry total	Grand total	Months' supply
	Plants	Warehouses	Total			
1946:						
March.....	8,469	23,062	31,531	57,098	88,629	1.74
June.....	10,560	12,848	23,408	39,204	62,612	1.19
September.....	10,134	22,648	32,782	42,366	75,148	1.40
December.....	10,456	17,570	28,026	53,457	81,483	1.55
1947:						
March.....	8,128	31,136	39,264	56,249	95,513	1.93
June.....	10,902	21,848	32,750	42,441	75,191	1.69
September.....	7,955	14,420	22,375	31,756	54,131	1.33
December.....	5,121	3,124	8,245	32,361	40,606	1.09
1948:						
March.....	6,601	6,457	13,058	37,374	50,432	1.49
June.....	7,522	24,967	32,489	38,912	71,401	2.30
September.....	6,128	40,341	46,469	37,849	84,318	2.79
December.....	7,471	50,205	57,676	38,606	96,282	3.35
1949:						
March.....	6,116	56,386	62,502	35,223	97,725	3.45
June.....	7,042	50,454	57,496	31,849	89,345	3.14
September.....	7,800	54,255	62,055	27,928	89,983	3.26
December.....	7,927	42,580	50,507	27,224	77,731	2.90
1950:						
March.....	5,678	29,942	35,620	30,760	66,380	2.52
June.....	5,555	13,778	19,333	28,654	47,987	1.72
September.....	4,932	7,326	12,258	30,647	42,905	1.39
December.....	7,453	3,144	10,597	26,345	36,942	1.07
1951:						
March.....	8,717	5,230	13,947	30,744	44,691	1.11
June.....	10,523	16,779	27,302	32,956	60,258	1.36
September.....	11,716	25,075	36,791	44,147	80,938	1.66

Source: NPA, Rubber Division.

The Government, for its part, has been interested in the maintenance of reasonable working stocks at all times. The storage facilities at the GR-S plants are limited, and RFC has given more consideration to its holdings from the viewpoint of a fixed tonnage limit than from the viewpoint of months' supply. Their operations are most efficiently conducted with low stocks, and the tonnage carried has averaged about 33,000 long tons from 1946 through 1951. There was policy resistance in Government circles to the warehousing of large stocks of GR-S at public expense as an insurance of industry supplies. As production declined in 1948 and 1949 however, Government stocks were built to their highest point (62,502 long tons, March, 1949) since the war, and they were well above average at the start of 1950.

Members of industry have from time to time urged that carriage of large stocks of GR-S by the Government is desirable from the standpoint of national security. Industry urgings have been considered in some quarters as less than fully frank in stating the reasons for their advocacy. There are sound technical reasons for avoiding large accumulations of GR-S, aside from warehousing and increased handling costs which it would entail. The principal technical objection is that the subtypes of GR-S produced are constantly being changed and improved. The newest types are quick in winning popularity, and are usually in greatest demand; the disposal of types becoming obsolescent is always difficult and sometimes a price discount is necessary. Consequently, the types that could most readily be stockpiled at any time would be chiefly those least in demand, and hence most difficult to dispose of later, which would make rotation complicated. For example, today there is demand for all the cold rubber that can be produced; only hot GR-S could be stockpiled

unless sales of the cold rubber were curtailed to permit its stockpiling; perhaps tomorrow's demand will be for oil-extended types.

It would seem on the basis of experience to date, that our greatest need for high stocks of GR-S is when its production is low, and that large stocks when production is high are to be avoided. However, the dangers of accumulating obsolescent types are paramount.

C. RECLAIMED RUBBER

Throughout the world, the general custom is to carry only necessary working stocks of reclaimed rubber. This material is nearly all used in the countries where it is produced. Many small reclaiming plants with limited equipment are adjuncts of company establishments engaged in the manufacture of rubber products.

Table VIII, C(1) provides statistics of stocks of reclaim in countries which report this information, for years since 1945. In this table, the United States stocks are reported in months' supply as well as tons. American manufacturers of reclaim adjust their production closely to the demand and avoid large stock accumulations, and this is apparently the situation in other countries. Protective inventories of scrap rubber are held by American reclaimers, and their productive capacity has always been great enough to enable them to meet promptly the rising demands of industry in past emergencies, although this has at times caused stocks to be temporarily reduced to a bare minimum working level.

Table VIII, C(1).—REPORTED STOCKS OF RECLAIMED RUBBER

[Long tons]

End of—	United States		United Kingdom	Germany	Australia	Canada
	Stocks	Months' supply				
1945.....	28,155	1.40	3,576	n.a.	1,469	2,219
1946.....	33,666	1.47	5,330	n.a.	818	3,455
1947.....	35,943	1.50	4,334	n.a.	1,347	2,282
1948.....	32,630	1.50	4,245	n.a.	956	1,829
1949.....	28,263	1.52	2,272	3,674	692	1,845
1950.....	35,708	1.41	2,519	3,435	916	1,755

n.a. Not available.

Source: Rubber Statistical Bulletin, International Rubber Study Group.

IX

Rubber Consumption

IX

Rubber Consumption

Previous sections deal with materials which can best be discussed under the three headings—natural, synthetic, and reclaimed rubber. Consumption, however, in the case of nations and of important manufacturers, is a composite of all these classes of rubber, and can best be discussed under regional headings.

A. WORLD CONSUMPTION OF NATURAL AND SYNTHETIC RUBBER

The broad picture presented in table IX, A(1), shows the world consumption rising despite depressions and war during the past thirty years. A continuing rise in consumption is the logical expectation. However, there have been years of sharp recession, and because of the uncertainties of economics it is not safe to project a definite tonnage year by year into the future even if world peace is assumed. The increase in consumption, percentagewise, tends to diminish as the base becomes larger. It is a striking fact, however, that the *average* consumption in each decade has been higher than the peak consumption in any year during the preceding decade.

Table IX, A(1).—WORLD CONSUMPTION OF NATURAL AND SYNTHETIC RUBBER, 1920-50
[In 1,000 long tons]

Year	United States			Other countries			World total		
	Natural	Synthetic	Total	Natural	Synthetic*	Total	Natural	Synthetic*	Total
1920.....	206.0	.....	206.0	91.5	.....	91.5	297.5	.....	297.5
1921.....	177.8	.....	177.8	99.7	.....	99.7	277.5	.....	277.5
1922.....	301.5	.....	301.5	103.5	.....	103.5	405.0	.....	405.0
1923.....	319.4	.....	319.4	125.6	.....	125.6	445.0	.....	445.0
1924.....	328.8	.....	328.8	136.2	.....	136.2	465.0	.....	465.0
1925.....	388.5	.....	388.5	164.0	.....	164.0	552.5	.....	552.5
1926.....	366.2	.....	366.2	176.3	.....	176.3	542.5	.....	542.5
1927.....	373.0	.....	373.0	222.0	.....	222.0	595.0	.....	595.0
1928.....	437.0	.....	437.0	248.0	.....	248.0	685.0	.....	685.0
1929.....	467.4	.....	467.4	337.6	.....	337.6	805.0	.....	805.0
1930.....	376.0	.....	376.0	334.0	.....	334.0	710.0	.....	710.0
1931.....	355.2	.....	355.2	327.3	.....	327.3	682.5	.....	682.5
1932.....	336.7	.....	336.7	353.3	.....	353.3	690.0	.....	690.0
1933.....	412.4	.....	412.4	410.1	.....	410.1	822.5	.....	822.5
1934.....	462.5	.....	462.5	457.5	.....	457.5	920.0	.....	920.0
1935.....	491.5	.....	491.5	448.5	.....	448.5	940.0	.....	940.0
1936.....	575.0	.....	575.0	470.0	.....	470.0	1,045.0	.....	1,045.0
1937.....	543.6	0.5	544.1	546.4	2.5	548.9	1,090.0	3.0	1,093.0
1938.....	437.0	1.0	438.0	518.0	5.0	523.0	955.0	6.0	961.0
1939.....	592.0	2.0	594.0	513.0	13.0	526.0	1,105.0	15.0	1,120.0
1940.....	648.5	2.9	651.4	461.5	39.6	501.0	1,110.0	42.5	1,152.5
1941.....	775.0	6.3	781.3	465.0	66.2	531.2	1,240.0	72.5	1,312.5
1942.....	376.8	17.7	394.5	388.2	94.8	483.0	765.0	112.5	877.5
1943.....	317.6	170.9	488.5	297.4	121.6	419.0	615.0	292.5	907.5
1944.....	144.1	566.7	710.8	243.4	170.8	414.2	387.5	737.5	1,125.0
1945.....	105.4	693.6	799.0	157.1	171.4	328.5	262.5	865.0	1,127.5
1946.....	277.6	761.7	1,039.3	277.4	150.8	428.2	555.0	912.5	1,467.5
1947.....	562.7	559.7	1,122.4	547.3	65.3	612.6	1,110.0	625.0	1,735.0
1948.....	627.3	442.1	1,069.4	795.2	37.9	833.1	1,422.5	480.0	1,902.5
1949.....	574.5	414.4	988.9	863.0	35.6	898.6	1,437.5	450.0	1,887.5
1950.....	720.3	538.3	1,258.6	984.7	41.7	1,026.4	1,705.0	580.0	2,285.0

* Exclusive of Russian-produced synthetics.

Source: Compiled by NPA Rubber Division.

Throughout the history of rubber consumption until about 1905, the United States usually consumed between 40 and 45 percent of the natural rubber used annually in the world. Mass production and widespread use of automobiles in this country, and the effects of World War I, boosted our percentage to above 70 for a time following that war. Then the consumption in foreign countries began to grow more rapidly than in the United States, until just before World War II our country was using between 45 and 50 percent of the natural rubber consumed annually. In World War II and the years immediately after, our percentage of total natural and synthetic rubber increased again, but since 1947 other countries have been increasing their consumption rapidly.

Our swing to the use of synthetic rubber makes us less dependent on foreign sources of natural rubber. Other countries except Russia and Canada are using natural rubber almost exclusively. It results that natural rubber-producing countries, while still finding their largest individual market for natural rubber in the United States, are gradually becoming overwhelmingly dependent on the aggregate market elsewhere for their sales. When our stockpiling of natural rubber ceases, this will become more apparent. This situation seems likely to continue until and unless leading foreign rubber-consuming nations turn to increased use of synthetic rubber. Whether this will affect the political leanings of rubber-producing countries is worthy of consideration.

In this connection, although Russia produces and uses large quantities of synthetic rubber [not included in the statistics in IX, A(1)], Russia in the last few years has been importing natural rubber at the rate about three times the prewar rate, probably stockpiling a substantial quantity. It is unlikely that Russia will in any predictable future period rival the United States as a consumer of natural rubber. The United Kingdom and the Empire countries, however, bid fair to rival us in the not too distant future, particularly if we continue to consume large amounts of synthetic and they continue to use natural rubber almost exclusively.

If a time of economic distress for natural rubber producers should come, the UK and Empire would presumably support the Malayan rubber-producing industry as much as possible. France uses more natural rubber than Indochina (Viet Nam and Cambodia) produces, and once in the past supported the industry in Indochina by a tax on consumption in France. Brazil and India consume the rubber produced locally; the former subsidizes production, and India probably will do so if prices are low in future. Indonesia, Thailand, and Ceylon since its independence, are the independent Far Eastern producing countries which would in such a case have to seek a market where it could be found. At present, the United States is buying nearly all the Thai output.

The average world consumption has risen from 548,000 long tons in 1921-30 to 942,000 in 1931-40, and to 1,463,000 tons in 1941-50. The depression of the early 1930's retarded consumption in that decade. Since then, deficit spending throughout the world has been a factor boosting rubber consumption. The 1950 total stands out far above all previous records for world rubber consumption.

B. UNITED STATES

(a) Consumption of Rubber By Types

The types of rubber consumed in the United States since 1935 are reported in table IX, B(1), p. 3. The types of rubber are purposely set forth in some detail, in order to emphasize their multiplicity. Except in the 1942-46 period of World War II, when consumption was by Government regulation forced to employ the available types of rubber, the choice of the industry as to materials has been heavily influenced by economic considerations.

In a comparatively free industry, the tendency has been to use the lowest-priced material that would result in the production of goods of adequate quality. "Adequate quality" includes the demands of ultimate consumers for finished goods of varying qualities depending upon prices and consumer incomes, and is therefore not a fixed standard for years of prosperity and years of business depression, or for low income as well as high income owners of motor vehicles. Furthermore,

adequate quality during peacetime is different from what we can get by with adequately during wartime, when vehicle speed and load restrictions, for example, can be used to reduce the performance requirements of tires. In the early 1930's the price of natural rubber was very low, and the percentage use of reclaim by 1935 had fallen to a low figure; its use increased with higher prices for natural rubber in 1936 and 1937, and again in 1939-41. In most of the 1947-49 period the price of natural rubber of average quality was competitive with GR-S and Butyl, and there was a tendency towards increased use of natural to replace these synthetics and Neoprene. Although Butyl tubes are definitely superior to natural rubber tubes, there are many car drivers who will buy the latter at a few cents discount in price. With very high prices for natural rubber in 1950 and early 1951, the industry used all the synthetics and reclaim available and would certainly have done the same in absence of Government control of consumption.

The tons of the different rubbers used can be added to totals, but their individual characteristics and applicabilities for particular purposes are not capable of such addition. By and large, each manufacturer builds his reputation on excellence of quality of his products. This naturally leads each to choose in general the particular materials which will yield the best results for the purposes intended.

Table IX, B(1).—U.S. ESTIMATED CONSUMPTION OF RUBBER BY TYPES, 1935-50

[In 1,000 long tons]

Year	Natural			SYNTHETIC								Total new rubber	Reclaimed rubber
	Dry ¹	Latex ¹	Total	GR-S		Other S-Type ⁴	Butyl	Neoprene ²		N-Type ²	Total		
				Dry	Latex ³			Dry	Latex				
1935..	478.0	13.5	491.5	.....	.....	.....	.....	0.2	.....	.....	0.2	491.7	117.5
1936..	559.6	15.4	575.0	.....	.....	.....	.....	0.3	.....	.....	0.3	575.3	141.5
1937..	524.4	19.2	543.6	.....	.....	.....	.....	0.5	.....	.....	0.5	544.1	162.0
1938..	418.5	18.5	437.0	.....	.....	.....	.....	1.0	.....	.....	1.0	438.0	120.8
1939..	567.1	24.9	592.0	.....	.....	.....	.....	1.9	.....	.....	1.9	593.9	170.0
1940..	620.2	28.3	648.5	.....	.....	.....	.....	2.7	.....	0.2	2.9	651.4	190.2
1941..	741.9	33.1	775.0	.....	.....	0.1	.....	4.5	.....	1.7	6.3	781.3	251.2
1942..	367.4	9.4	376.8	1.0	.....	1.6	.....	6.6	0.2	8.2	17.6	394.4	254.8
1943..	308.1	9.6	317.7	131.0	.2	0.8	0.3	24.8	1.4	12.4	170.9	488.6	291.9
1944..	138.0	6.1	144.1	488.1	6.0	1.4	10.8	41.8	4.4	14.1	566.6	710.7	251.1
1945..	101.5	3.9	105.4	583.9	14.5	1.7	43.0	35.6	6.8	8.0	693.5	798.9	241.0
1946..	271.9	5.7	277.6	607.9	23.5	0.7	79.2	31.4	13.0	6.0	761.7	1,039.3	275.4
1947..	548.8	13.9	562.7	423.8	22.5	2.3	68.8	31.2	6.5	4.5	559.6	1,122.3	288.4
1948..	598.8	28.5	627.3	312.7	21.5	11.1	58.9	26.5	5.2	5.8	442.1	1,069.4	261.1
1949..	538.4	36.1	574.5	277.9	21.5	21.7	52.7	28.0	3.8	3.8	414.4	988.9	222.7
1950..	664.1	56.1	720.2	357.4	31.0	27.8	66.3	38.3	5.5	11.9	538.2	1,258.4	303.7

¹ Approximate through 1941.

² Approximate through 1940.

³ Approximate, including domestic and imported S-Type latex.

⁴ Includes imported S-Type (from Canada), and privately produced S-Type (High-styrene).

Source: NPA Rubber Division and predecessor agencies, and Commerce Department records.

It is customary to speak of GR-S as general purpose rubber, and as a single material, capable of replacing natural rubber in a wide range of applications. But GR-S is a blend (copolymer) of butadiene and styrene. Butadiene may itself be polymerized to make a soft rubber-like material of limited usefulness; styrene is polymerized to make hard plastic products; the blend can be anything between these extremes. Natural rubber similarly includes a wide range of types and qualities.

It would be preferable to think of *all* rubbers as special purpose, today, instead of describing some as general purpose. The plantation rubber producers have brought out special products for particular applications from time to time. It is approaching a situation in which all rubbers are tailor-made for special uses, not merely in particular products, but also in particular parts of products, and in lines of different quality and different price levels.

The consumption of latices amounted to 92,600 long tons in 1950, or 7.36 percent of total new rubber consumption, compared with 4.35 percent in 1940. Consumption of latices has shown very rapid growth since the war.

(b) Consumption of Rubber By Uses

Information on this subject is incomplete and spotty, but reasonably indicative of the relative importance of principal products in our total consumption of rubber and of the relative usage of synthetic rubbers and natural rubber in major products for stated periods.

Statistics of the Rubber Manufacturers Association, Inc., relative to the pre-war consumption of natural rubber in main classes of products, are shown in table IX, B(2), below for the 1935-40 period. The statistics are incomplete; those for consumption in tires and tubes are known to be more complete than those for tire sundries and repair materials, or than those listed under "other rubber products." Pneumatic casings for motor vehicles were of course the leading item, followed by mechanical rubber goods, inner tubes, boots and shoes, heels and soles, etc.

Estimates of new rubber consumption by products, purporting to be complete, have been made for the twelve months ended March 31, 1941, and the calendar year 1949. These are shown in table IX, B(3), p.5. The 1949 consumption in individual transportation products shown in this table were worked out with a high degree of accuracy; the other estimates are rough approximations. Note that the consumption is separately shown for different classes of tires, and for different classes of inner tubes. The 1949 figure for consumption in wires and cables is officially compiled and not an estimate.

Table IX, B(2).—U. S. CONSUMPTION OF NATURAL RUBBER BY CLASSES OF PRODUCTS, 1935-40

[Long tons]						
Product	1935	1936	1937	1938	1939	1940
TIRES AND TIRE SUNDRIES						
Pneumatic casings (all types except bicycle & aeroplane)	272,394	294,443	275,981	206,132	278,738	286,254
Pneumatic tubes.....	41,105	43,582	41,643	31,174	40,763	41,007
Farm tractor tires and tubes.....	(*)	(*)	(*)	(*)	(*)	10,486
Bicycle tires including juvenile pneumatics.....	2,167	3,361	2,908	1,923	2,848	2,794
Aeroplane tires and tubes.....	134	163	185	210	301	628
Motorcycle tires and tubes.....	(*)	(*)	(*)	(*)	(*)	294
Solid and cushion tires for highway transport.....	1,094	505	487	305	239	214
All other solid and cushion tires.....	365	757	627	154	366	600
Tire sundries and repair materials.....	8,021	6,701	7,559	8,093	10,437	10,133
Total—tire and tire sundries.....	325,280	349,512	329,390	247,991	333,692	352,410
OTHER RUBBER PRODUCTS						
Mechanical rubber goods.....	38,887	44,717	46,772	27,351	40,470	44,696
Boots and shoes.....	18,239	21,329	20,150	13,029	15,637	15,461
Insulated wire and cable compounds.....	4,679	6,426	7,193	5,041	5,639	8,193
Druggist sundries, medical and surgical goods.....	3,421	3,205	3,781	2,716	3,859	3,730
Stationers' rubber goods.....	1,680	2,005	1,996	1,743	2,181	2,209
Bathing apparel.....	789	991	952	596	586	620
Rubber clothing.....	1,020	565	575	467	497	533
Automobile fabrics.....	656	494	425	369	338	378
Other rubberised fabrics.....	4,075	4,180	4,015	3,499	4,196	3,979
Hard rubber goods.....	2,038	2,203	2,484	1,711	2,561	3,492
Heels and soles.....	10,271	8,749	9,635	9,904	12,888	11,336
Rubber flooring.....	780	1,002	1,150	833	1,231	1,417
Sponge rubber.....	3,662	3,107	4,131	2,706	4,720	9,867

* Information not available.

Table IX, B(2).—U. S. CONSUMPTION OF NATURAL RUBBER BY CLASSES OF PRODUCTS, 1935-40—Continued

[Long tons]

Product	1935	1936	1937	1938	1939	1940
OTHER RUBBER PRODUCTS—Continued						
Sporting goods, toys and novelties.....	2,153	2,357	1,980	1,734	2,285	2,226
Miscellaneous rubber sundries.....	3,215	3,195	3,077	2,156	3,567	2,450
Total—other rubber products.....	95,565	104,525	108,316	73,855	100,655	110,587
Grand total—all products.....	420,845	454,037	437,706	321,846	434,347	462,997

N. B. The above figures are not complete for the whole of the United States rubber industry. The grand totals given above are approximately 86 percent complete for the year 1935; 79 percent for 1936; 80.5 percent for 1937; 73.6 percent for 1938; 73.4 percent for 1939; 71.4 percent for 1940; and for 1941 the following: 1st quarter 73.2 percent; 2nd quarter 75.4 percent. Individual items would vary widely from these percentages.

Source: Rubber Manufacturers Association, Inc.

Table IX, B(3).—ESTIMATED U. S. CONSUMPTION OF NEW RUBBER, BY PRODUCTS, 1941 AND 1949

Product	Year ended March 31, 1941		Calendar year 1949	
	Long tons	Percent	Long tons	Percent
Tires:				
Passenger car.....	249,000	36.4	316,511	32.0
Truck and bus.....	139,000	20.4	160,912	16.3
Tractor and implement.....	21,000	3.1	44,058	4.5
Other.....			18,055	0.8
Total.....	409,000	59.9	529,536	53.6
Repair materials, etc.:				
Camelback.....	18,000	2.7	² 35,103	3.6
Other.....			³ 15,838	1.6
Total.....	18,000	2.7	50,941	5.2
Inner tubes:				
Passenger car.....	55,000	8.0	48,044	4.9
Truck and bus.....			21,352	2.1
Tractor and implement.....			7,531	0.8
Other.....			⁴ 2,129	0.2
Total.....	55,000	8.0	79,056	8.0
Nontransport:				
Latex foam.....	15,000	2.2	28,000	2.8
Boots and shoes.....	18,000	2.6	17,200	1.7
Heels and soles.....	22,000	3.2	32,000	3.2
Insulated wire and cable.....	22,000	3.2	30,613	3.1
Mechanical goods:				
Belting.....	67,000	9.8	16,500	1.7
Hose and tubing.....			17,750	1.8
Molded and extruded.....			13,900	1.4
Flooring and matting.....			10,500	1.1
Thread and cement.....			20,200	2.0
Other.....			⁵ 19,750	2.0
Coated fabrics and clothing.....	10,000	1.5	8,750	0.9
Drug sundries.....	7,000	1.0	10,000	1.0
Balloons, balls and toys.....	⁶ 41,000	5.9	14,200	1.4
Other rubber industry products.....			50,007	5.0
Products of other industries ⁷			40,000	4.1
Total nontransport.....	202,000	29.4	329,370	33.2
Grand total.....	684,000	100.0	988,903	100.0

¹ Includes airplane tires 2,012 tons.

² Includes passenger sizes 16,117 tons, truck-bus 18,986 tons.

³ Includes tire flaps 4,893 tons.

⁴ Includes airplane tubes 257 tons.

⁵ Includes pack-

ing 2,000 tons, rubber and friction tapes 3,000 tons, other products 14,750 tons.

⁶ Includes hard

rubber goods 5,000 tons, sporting goods 4,000 tons, miscellaneous sundries 12,000 tons, and other products 20,000 tons.

⁷ Rubber consumed by manufacturers of paper, paint, electrical, textile,

plastic, toys and sports goods.

Source: 1949—NPA Rubber Division; 1941—Rubber Manufacturers Association, Inc.

(c) Transport and Non-Transport Consumption

The consumption, divided between transport and non-transportation products, of total natural rubber, total synthetics, and reclaim can be estimated with reasonable accuracy for prewar years from Census data, and data was reported and compiled from 1944 onwards. With estimates for the missing years, table IX, B(4) has been constructed providing a picture of the division of consumption between, and its trend in these two branches of the industry.

Until 1943 synthetic rubber was used in tires only experimentally; nearly all the synthetics were used in non-transportation products.

Table IX, B(4).—U. S. ESTIMATED CONSUMPTION OF RUBBER IN TRANSPORT AND NONTRANSPORT PRODUCTS, 1935-50

[In 1,000 long tons]

Year	Total new rubber	Natural rubber	Percent	Synthetic rubber	Percent	Reclaimed rubber	Ratio to new rubber
Transport products							
1935.....	378.5	378.5	100.0	.....	.....	56.8	15.0
1937.....	424.0	424.0	100.0	.....	.....	82.2	19.4
1939.....	442.7	442.5	100.0	.....	.....	71.5	16.2
1940.....	457.5	457.5	100.0	.....	.....	73.3	16.0
1941.....	525.0	525.0	100.0	.....	.....	84.0	16.0
1942.....	269.9	267.7	99.2	2.2	0.8	90.7	33.6
1943.....	348.8	231.8	66.5	117.0	33.5	118.8	34.1
1944.....	491.1	111.4	22.7	379.7	77.3	76.9	15.7
1945—first half.....	309.6	52.5	17.0	257.1	83.0	51.9	16.8
second half.....	280.6	34.5	12.3	246.1	87.7	44.9	16.0
Total.....	590.2	87.0	14.7	503.2	85.3	96.8	16.4
1946.....	771.7	222.8	28.9	548.9	71.1	107.9	14.0
1947.....	830.6	442.7	53.3	387.9	46.7	116.6	14.0
1948.....	744.6	443.0	59.5	301.6	40.5	112.4	15.1
1949.....	659.5	382.6	58.0	276.9	42.0	111.0	16.8
1950.....	818.2	477.5	58.4	340.7	41.6	143.2	17.5
Nontransport products							
1935.....	113.2	113.0	99.8	0.2	0.2	60.7	53.6
1937.....	120.1	119.6	99.6	0.5	0.4	77.8	64.8
1939.....	151.1	149.2	98.7	1.9	1.3	98.5	65.2
1940.....	193.6	191.0	98.7	2.6	1.3	116.9	60.4
1941.....	256.3	250.0	97.5	6.3	2.5	167.2	65.2
1942.....	124.5	109.1	87.6	15.4	12.4	164.1	131.8
1943.....	139.7	85.9	61.5	53.8	38.5	172.3	123.3
1944.....	219.7	32.7	14.9	187.0	85.1	174.2	79.3
1945—first half.....	122.0	9.1	7.4	112.9	92.6	77.6	64.6
second half.....	86.8	9.4	10.8	77.4	89.2	66.6	76.8
Total.....	208.8	18.5	8.9	190.3	91.1	144.2	69.1
1946.....	262.2	54.8	20.9	207.4	79.1	167.5	63.9
1947.....	291.6	119.8	41.1	171.8	58.9	171.8	58.9
1948.....	324.8	184.3	56.7	140.5	43.3	148.7	45.8
1949.....	329.4	191.9	58.3	137.5	41.7	111.6	33.9
1950.....	440.3	242.8	55.1	197.5	44.9	160.6	36.5

Source: NPA Rubber Division.

As GR-S and Butyl became available in large quantities there was a progressive decline in the use of natural rubber in tires, tubes, and camelback from 99 percent in 1942, to 66 percent in 1943, and on down to only 12.3 percent in the second half of 1945 (the low point). Thereafter, as natural rubber supplies made it possible, its percentage use was increased rapidly in transport goods until it approached 60 percent, remaining near that level until 1951. In transport goods the ratio of reclaim to new rubber, since 1942 and 1943, has been comparable to its prewar ratio.

The curbs on use of natural rubber were more drastic for non-transport products than for transport products during the war; synthetics replaced natural rubber earlier and more completely. After the war authorities allocated natural rubber both to transport and non-transport goods until September 1947, when manufacturers of the latter were granted free choice of materials (with the minor exception of natural latex for seat cushioning until May 1948). Since the start of 1948, despite this free choice a slightly lower percentage of natural has been used in nontransport than in transport products.

Experience in the latter part of 1951, when the price of natural rubber was still sufficiently higher than that of synthetic to call for its use wherever feasible, and supplies of most synthetics were ample, indicates that a full range of adequate civilian products, plus those military products needed to support the Korean effort, calls for at least 35 per cent natural rubber. While the record shows that it was possible to get along with only 12.3 percent natural rubber in transport goods and only 7.4 percent in nontransport goods during a half-year period in 1945 during a dire shortage of natural rubber, the consensus is that these limits did not result in ample products of adequate quality. Essential civilian and military products of adequate quality in a future emergency would require at least 15 percent natural rubber.

The ratio of reclaim to new rubber in nontransport goods before the war averaged over 60 percent. Peak percentage use of reclaim occurred in 1942. Thereafter a decline in the ratio occurred each year through 1949, and the ratio in 1949 and 1950 averaged only 35 percent. The market for reclaim in nontransport goods has been permanently reduced, it appears, by the development and use of synthetics.

During the period 1944-46, when peak percentage use of synthetics occurred, records of consumption of rubber by types, divided by chief transportation products, were compiled by the Office of the Rubber Director and successor agencies. Table IX, B(5) shows summary statistics from these records. Pneumatic casings used relatively little new rubber other than GR-S and natural, the latter chiefly in truck and bus tires. Inner tubes used Butyl to the extent of available supplies, GR-S (at first) and natural rubber (later) for remaining tube requirements. Camelback was made from GR-S with only small quantities of natural rubber.

The item "other transportation" in this table covers casings and tubes for airplane, bicycle, and industrial pneumatics; military bogie rollers, tank blocks, treads, and tracks; solid tires; airbags for curing tires; and tire and tube repair materials other than camelback, the details concerning which would probably not be very significant in a new emergency in view of the advances in technology of synthetic rubber types and application. Statistics on the consumption of reclaim in individual products were not compiled except for 1944 as shown in the footnote. The Neoprene and N-Type rubbers were mostly used in non-transportation products, concerning individual items of which no detail was compiled.

Table IX, B(6) shows, for 1947-50, the consumption of rubber in transport compared with nontransport products in somewhat greater detail by types of rubber than in previous tables. The natural rubber latex has been mostly used in non-transport goods, and the synthetic latices likewise find their applications in that field although separate statistics on their consumption are not compiled. By far the chief product of latex is foamed latex cushion material for seat cushions, upholstery, mattresses and pillows, but there is also a large use in dipped rubber sundries and toys, in adhesives and cements, in paper products, and in paints. Consumption of latices has increased rapidly during recent years, and the fact that latex products contain practically no reclaimed rubber is a very important factor in the decline in percentage use of reclaim in nontransport products as a whole. Note that the use of Neoprene and N-Type rubbers in transport goods, and use of Butyl in nontransport goods have been unimportant.

Table IX, B(5).—ESTIMATED NEW RUBBER CONSUMED IN TIRES AND OTHER PRODUCTS, 1944-46

[Long tons]

Item and year	Natural	GR-S and other	Natural	Butyl	GR-S and other
	Casings		Inner tubes		
Passenger car:					
1944.....	1,677	83,751	174	150	11,575
1945.....	1,876	123,525	226	3,056	18,665
1946.....	34,811	266,119	276	50,736	1,036
Truck and bus:					
1944.....	75,202	147,856	4,484	8,003	15,346
1945.....	62,321	194,385	167	31,967	921
1946.....	152,287	112,057	19,376	14,260	0
Tractor and implement:					
1944.....	769	15,294	27	0	3,630
1945.....	433	21,016	23	2,325	3,631
1946.....	3,023	39,471	359	8,359	171
	Camelback		Other transportation		
In camelback and for other transportation:					
1944.....	4,550	71,150	24,532	0	22,894
1945.....	4,073	72,135	17,853	3,819	27,936
1946.....	4,141	41,604	8,526	5,045	10,014
Item and year	Natural	GR-S	Neoprene	N-Types	Butyl
In other products:					
1944.....	32,698	124,244	46,055	14,112	2,610
1945.....	18,457	138,775	41,550	8,029	1,845
1946.....	54,797	162,583	43,429	5,988	826

Note: The estimates of reclaimed rubber consumed in 1944 are as follows, in long tons: Casings—passenger car, 14,257; truck and bus, 18,445; tractor and implement, 10,966; inner tubes—552; Camelback—26,528; other transportation—4,724; and all other—174,208.

Source: Compiled from records of Statistical Section of Rubber Division, CPA.

Separate statistics have been compiled on the consumption of rubber in insulated wires and cables, and are included in this table; note that about a third of the total Neoprene consumption is in this field, where its superior properties more than offset its high cost compared with other rubbers in the period.

Manufacturers in the United States were asked to estimate, in advance for the third quarter of 1951, their consumption of each type of rubber byproducts. The tabulation of these statistics yields the most comprehensive information that has ever been available on this subject. The tabulations cover 31 classes of transportation products and 29 classes of non-transportation items. These statistics are advance estimates, not actual consumption, and represent the consumption in a single quarter of controlled consumption, not a period of free choice of materials; despite these conditions they reflect trade practice in the consumption of natural rubber (dry and latex separately) and each of the synthetic rubbers to a considerable extent.

Table IX, B(8) shows for each product class the consumption of each type of new rubber as a percent of the total proposed new rubber consumption for that class. Table IX, B(9) shows for each type of new rubber, the distribution of consumption in each product class as a percent of the total consumption of that type of rubber. Table IX, B(10) provides information on the proposed consumption of reclaimed rubber in comparison with the total consumption of new rubber, for each class of products.

Table IX, B(6).—U. S. CONSUMPTION OF RUBBER BY TYPES IN TRANSPORT AND NONTRANSPORT, 1947-50

[In long tons]

Year	Natural rubber			Synthetic rubber						Total new rubber	Reclaimed rubber
	Dry	Latex	Total	GR-S	Other S-Type	Butyl	Neo-prene	N-Type	Total		
	Transportation										
1947..	441,048	1,684	442,742	319,817	.....	67,505	527	2	387,851	830,593	116,581
1948..	439,996	3,010	443,006	243,400	.....	57,531	589	55	301,575	744,581	112,408
1949..	380,525	2,066	382,591	225,047	.....	50,534	1,134	227	276,942	659,533	111,038
1950..	475,027	2,439	477,466	275,141	.....	63,159	2,119	334	340,753	818,219	143,180
	Nontransportation										
1947..	107,694	12,225	119,919	126,499	2,273	1,333	37,176	4,534	171,815	291,734	171,814
1948..	158,847	25,479	184,326	90,833	11,080	1,339	31,529	5,716	140,497	324,823	148,705
1949..	157,880	34,051	191,931	74,373	21,717	2,130	30,619	8,600	137,439	329,370	111,641
1950..	189,103	53,699	242,802	113,286	27,803	3,189	41,662	11,596	197,536	440,338	160,553
	Insulated wire and cable ¹										
1947..	.....	.....	5,726	17,138	(²)	(³)	10,001	182	27,321	33,047	3,553
1948..	.....	.....	8,361	14,223	(²)	(³)	10,910	310	25,443	33,804	2,530
1949..	.....	.....	6,519	11,459	(²)	(³)	12,126	508	24,093	30,612	1,445
1950..	.....	.....	7,944	14,627	(²)	(³)	14,296	572	29,495	37,439	2,179

¹ Included above under nontransportation.² Included with GR-S.³ Included with N-Type.

Source: NPA Rubber Division.

Table IX, B(7).—ANNUAL REQUIREMENT OF MAJOR NON-RUBBER MATERIALS USED IN U. S. RUBBER MANUFACTURING INDUSTRY¹

Item No.	Item and unit of measure	Requirements	Chief use
1	Steel.....short tons..	126,000	Bead wire in tires.
2	Copper.....thousand pounds..	15,171	Tube valves.
3	Aluminum.....do....	37,646	Fuel cells and mechanical rubber goods.
4	Nylon tire cord.....do....	18,367	Airplane tires.
5	High tenacity rayon tire cord.....do....	2504,294	Truck & bus, passenger & motorcycle, and tractor-implement tires.
6	Cotton tire cord.....do....	³ 120,366	Where rayon cord is short, and for industrial pneumatic tires.
7	Sulfur.....short tons..	81,275	Rubber vulcanization largely.
8	Carbon blacks.....thousand pounds..	1,241,546	To provide greater mileage in tire treads.
9	Plasticizers.....do....	214,099	Used as softeners in rubber masterbatch mixes.
10	Accelerators.....do....	35,683	To decrease curing time during vulcanization.
11	Anti-oxidants.....do....	35,683	To cut down aging in cured stocks.
12	Major basic chemicals: ⁴		
(a)	Aniline.....do....	60,015	Used to manufacture accelerators and anti-oxidants.
(b)	Beta-naphthol.....do....	12,650	Do.
(c)	Carbon Bisulfide.....do....	29,027	Do.
(d)	Diethylamine.....do....	2,971	Do.
(e)	Dimethylamine.....do....	4,675	Do.
(f)	Diphenylamine.....do....	13,452	Do.
(g)	Phenol.....do....	1,887	Do.
(h)	Sulfur for accelerators...short tons..	⁵ 5,056	Do.

¹ Based on annual rubber consumption of 1,593,000 long tons (462,000 natural, 812,000 synthetics, 319,000 reclaim).² Based on full rayon cord use in the output of 20,408,514 truck tires, 71,000,000 passenger and motorcycle tires, and 4,890,000 tractor-implement tires; and includes 33,792,000 pounds of rayon cord for non-transportation uses.³ Assumes a rayon cord shortage of 89,294,000 lbs. converted to cotton cord at 1.3 lbs. cotton for each pound rayon; and includes the output of 1,260,000 industrial pneumatic tires in cotton cord. The rayon shortage is based on an estimated annual availability of 415 million pounds.⁴ The quantities shown for the eight major basic chemicals herein listed, plus many other chemicals less susceptible to shortage or of subsidiary importance, normally would result in the end-product requirement figures specified for accelerators and anti-oxidants (items 10 and 11).⁵ Also included in item 7 (Sulfur) so as to show total sulfur requirement.

Table IX, B(8).—TYPE OF RUBBER AS PERCENT OF TOTAL PROPOSED NEW RUBBER CONSUMPTION IN EACH PRODUCT,
3rd QUARTER 1951 (ESTIMATED)

Item No.	Product	Product code No.	Dry Natural	Natural Latex	GR-3	GR-1 (Butyl)	Neo-prene	All other	Total "new RHC"
TRANSPORTATION PRODUCTS (PERCENT)									
Tires:									
1	Airplane (large).....	1	96.4	1.7	1.9	.....	.....	.....	100.0
2	Airplane (small).....	1	98.2	1.0	.8	.....	.....	.....	100.0
3	Bicycle.....	1	14.2	.....	85.8	.....	.....	.....	100.0
4	Motorcycle.....	1	20.4	.1	79.5	.....	.....	.....	100.0
5	Passenger thru (6.50) & (7.10)....	1	16.1	.6	83.3	.....	.....	.....	100.0
6	Passenger over (6.50) & (7.10)....	1	24.1	.2	75.7	.....	.....	.....	100.0
7	Industrial pneumatic.....	1	20.0	.1	79.9	.....	.....	.....	100.0
8	Tractor implements (large).....	1	13.3	(*)	86.7	.....	.....	.....	100.0
9	Tractor implements (small).....	1	12.1	.1	87.8	.....	.....	.....	100.0
10	Truck (7.50) and under.....	1	33.1	.2	66.7	.....	.....	.....	100.0
11	Truck (8.25) thru (9.00).....	1	65.7	.2	34.1	.....	.....	.....	100.0
12	Truck (10.00) thru (12.00).....	1	82.3	.2	17.5	.....	.....	.....	100.0
13	Truck over (12.00).....	1	91.2	.2	8.6	.....	.....	.....	100.0
14	Solids—airplane.....	2	70.2	.....	.....	.....	29.8	.....	100.0
15	Solids—bogies, idlers and support rollers.....	2	4.9	.....	95.1	.....	(*)	.....	100.0
16	Solids—pressed and cured on.....	2	47.8	.....	43.2	.....	9.0	(*)	100.0
Tubes:									
17	Airplane.....	3	99.8	.....	.....	.2	.....	.....	100.0
18	Bicycle.....	3	.....	.....	.....	100.0	.....	.....	100.0
19	Industrial.....	3	12.7	.....	.....	87.3	.....	.....	100.0
20	Passenger and motorcycle.....	3	3.0	.....	.....	97.0	.....	.....	100.0
21	Tractor implements.....	3	.....	.....	.....	100.0	.....	.....	100.0
22	Truck (8.25) and under.....	3	.3	.....	.....	99.7	.....	.....	100.0
23	Truck (9.00) thru 13.00).....	3	2.3	.....	.....	97.7	.....	.....	100.0
24	Truck (14.00) and over.....	3	79.0	.....	.....	21.0	.....	.....	100.0
25	Valves.....	4	10.3	.....	2.9	86.3	.2	.3	100.0
26	Curing bags.....	4	56.3	.....	(*)	42.8	.9	.....	100.0
27	Tire flaps.....	5	20.4	.....	79.6	.....	.....	.....	100.0
28	Camelback.....	6	10.3	.....	89.7	.....	.....	(*)	100.0
29	Other retread materials.....	6	81.9	.....	8.6	6.8	2.6	.1	100.0
30	Tire and tube repair materials.....	7	87.4	.....	12.1	.4	.....	.1	100.0
31	Tank blocks, treads and band tracks.....	8	18.3	.....	81.5	.....	(*)	.2	100.0
	Total proposed consumption (items 1-31).....	.....	34.7	.2	56.0	9.0	.1	(*)	100.0
32	Master batches or compounds made for and/or sold to others.....	.....	4.9	44.1	33.8	.....	14.1	3.1	100.0
33	Total proposed consumption.....	.....	34.3	.8	55.8	8.9	.2	(*)	100.0
NON-TRANSPORTATION PRODUCTS (PERCENT)									
1	Belts and belting.....	9	52.2	.1	35.2	(*)	11.9	.6	100.0
2	Hose.....	10	19.1	.....	40.2	1.3	33.3	6.1	100.0
3	Packing and gaskets.....	11	16.5	3.8	53.5	.9	15.1	10.2	100.0
4	Aircraft equipment.....	12a	40.8	.2	8.7	.1	33.7	16.5	100.0
5	Automotive equipment (include automotive mats).....	12b	27.7	.1	64.0	.9	5.9	1.4	100.0
6	Household and appliance products....	12f	36.7	.....	54.8	1.4	4.4	2.7	100.0
7	Mats and matting (exclude automotive mats).....	12n	12.4	.....	70.4	(*)	14.7	2.5	100.0
8	Hard rubber products (including auto battery containers).....	12p	19.0	1.8	78.5	(*)	.2	.5	100.0
9	Other miscellaneous mechanical goods	12	35.3	.2	38.9	2.0	14.7	8.9	100.0
10	Wire and cable.....	13	7.9	.7	48.7	2.4	39.7	.6	100.0
11	Rubber footwear.....	14	68.9	3.3	27.3	(*)	.5	.....	100.0
12	Heels and soles.....	15a	11.9	.9	82.5	.....	4.1	.6	100.0
13	Inner shoe cushions and pads.....	15d	3.0	4.4	80.6	.1	11.7	.2	100.0
14	Cements for shoes and shoe welding..	15g, h	17.4	47.9	5.6	.3	26.2	2.6	100.0

* Less than .05%.

Table IX, B(8).—TYPE OF RUBBER AS PERCENT OF TOTAL PROPOSED NEW RUBBER CONSUMPTION IN EACH PRODUCT,
3rd QUARTER 1951 (ESTIMATED)—Continued

Item No.	Product	Product code No.	Dry Natural	Natural Latex	GR-S	GR-I (Butyl)	Neo-prene	All other	Total "new RHC"
NON-TRANSPORTATION PRODUCTS (PERCENT)—Continued									
15	Other shoe products.....	15b, c, e, f, i, j, k, l	15.4	8.4	61.4	.....	9.4	5.4	100.0
16	Cements.....	16	14.1	18.4	28.8	7.2	24.3	7.2	100.0
17	Proofing, combining or coating of fabrics.....	17	17.0	1.8	55.2	6.1	12.2	7.7	100.0
18	Drug sundries.....	18	49.8	29.0	10.0	.1	10.1	1.0	100.0
19	Floatation and life saving equipment	19, 20	15.8	26.0	.7	.....	57.5	(*)	100.0
20	Bullet sealing fuel cells.....	21	48.5	.....	12.3	(*)	2.2	37.0	100.0
21	Athletic goods.....	22a	52.0	1.3	33.1	8.1	5.4	.1	100.0
22	Toys and balloons.....	22b, k	26.2	48.8	20.1	.....	4.8	.1	100.0
23	Sponge rubber products & rubberized fiber & hair cushioning.....	22c, m	35.0	6.1	52.9	(*)	6.0	(*)	100.0
24	Pressure sensitive tape.....	22f	59.2	.5	26.5	.2	.3	13.3	100.0
25	Thread and related products.....	22h	71.5	27.4	.....	.....	1.1	.....	100.0
26	Rubber flooring and floor covering..	22L	.1	2.3	94.7	.....	.5	2.4	100.0
27	Other miscellaneous products.....	22	39.0	.8	48.7	.6	2.8	8.1	100.0
28	Latex foam.....	23	.8	72.0	27.2	.....	(*)	.....	100.0
29	All other rubber products.....	24	45.9	4.2	24.4	2.0	9.7	13.8	100.0
30	Total proposed consumption....	.....	25.7	11.0	47.8	1.0	11.1	3.4	100.0

* Less than .05%.

Source: Summary of Forms NPAF-58 and NPAF-59.

Table IX, B(9).—TYPE OF RUBBER PROPOSED TO BE CONSUMED IN EACH PRODUCT AS PERCENT OF TOTAL PROPOSED CONSUMPTION OF THAT TYPE, 3rd QUARTER 1951 (ESTIMATED)

Item No.	Product	Product code No.	Dry Natural	Natural Latex	GR-S	GR-I (Butyl)	Neo-prene	All other	Total "new RHC"
TRANSPORTATION PRODUCTS (PERCENT)									
1	Tires:								
1	Airplane (large).....	1	1.0	.1	(*)	.....	.....	.....	.3
2	Airplane (small).....	1	.1	(*)	(*)	.....	.....	.....	(*)
3	Bicycle.....	1	.1	.....	.2	.....	.....	.....	.1
4	Motorcycle.....	1	(*)	(*)	(*)	.....	.....	.....	(*)
5	Passenger thru (6.50) & (7.10)....	1	8.9	2.4	27.2	.....	.....	.....	17.4
6	Passenger over (6.50) & (7.10)....	1	5.0	.3	9.4	.....	.....	.....	6.7
7	Industrial pneumatic.....	1	.1	(*)	.2	.....	.....	.....	.1
8	Tractor implements (large).....	1	1.0	(*)	3.8	.....	.....	.....	2.3
9	Tractor implements (small).....	1	.3	(*)	1.4	.....	.....	.....	.8
10	Truck (7.50) and under.....	1	6.8	.3	8.2	.....	.....	.....	6.5
11	Truck (8.25) thru (9.00).....	1	15.3	.3	4.7	.....	.....	.....	7.4
12	Truck (10.00) thru (12.00).....	1	21.9	.4	2.8	.....	.....	.....	8.4
13	Truck over (12.00).....	1	7.1	.1	.4	.....	.....	.....	2.5
14	Solids—airplane.....	2	(*)	.....	.....	.....	(*)	.....	(*)
15	Solids—bogies, idlers and support rollers.....	2	.1	.....	1.1	.....	(*)	.....	.6
16	Solids—pressed and cured on.....	2	.5	.....	.2	.....	.8	(*)	.3
17	Tubes:								
17	Airplane.....	3	.2	.....	.....	(*)	.....	.....	.1
18	Bicycle.....	3	.....	.....	.....	1.7	.....	.....	.1
19	Industrial.....	3	(*)	.....	.....	.6	.....	.....	(*)
20	Passenger and motorcycle.....	3	.3	.....	.....	48.4	.....	.....	3.2
21	Tractor implements.....	3	.....	.....	.....	9.5	.....	.....	.6
22	Truck (8.25) and under.....	3	(*)	.....	.....	14.3	.....	.....	.9
23	Truck (9.00) thru (13.00).....	3	.1	.....	.....	16.8	.....	.....	1.1
24	Truck (14.00) and over.....	3	.4	.....	.....	.5	.....	.....	.2

* Less than .05%.

Table IX, B(9).—TYPE OF RUBBER PROPOSED TO BE CONSUMED IN EACH PRODUCT AS PERCENT OF TOTAL PROPOSED CONSUMPTION OF THAT TYPE, 3rd QUARTER 1951 (ESTIMATED)—Continued

Item No.	Product	Product code No.	Dry Natural	Natural Latex	GR-S	GR-I (Butyl)	Neo-prene	All other	Total "new RHC"
TRANSPORTATION PRODUCTS (PERCENT)—Continued									
25	Valves.....	4	(*)	.....	(*)	.8	(*)	(*)	.1
26	Curing bags.....	4	.6	.....	(*)	2.3	.1	.....	.3
27	Tire flaps.....	5	.5	.....	1.2	.....	.....	.....	.8
28	Camelback.....	6	1.6	.....	8.4	.....	.....	.1	5.0
29	Other retread materials.....	6	.8	.....	.1	.3	.2	(*)	.3
30	Tire and tube repair materials.....	7	.6	.....	.1	(*)	.....	(*)	.2
31	Tank blocks, treads and band tracks.....	8	.6	.....	1.5	.....	(*)	.2	1.0
	Total proposed consumption (items 1-31).....	.....	74.0	4.1	70.9	95.2	1.1	.3	67.3
32	Master batches or compounds made for and/or sold to others.....	.....	.1	9.8	.6	.....	3.4	2.6	.9
33	Total proposed consumption.....	.....	74.1	13.9	71.5	95.2	4.5	2.9	68.2
NON-TRANSPORTATION PRODUCTS (PERCENT)									
1	Belts and belting.....	9	2.1	(*)	.9	(*)	4.2	.7	1.3
2	Hose.....	10	1.2	.....	1.5	.4	17.5	10.7	1.9
3	Packing and gaskets.....	11	.7	1.3	1.4	.2	5.7	12.9	1.4
4	Aircraft equipment.....	12a	.2	(*)	(*)	(*)	1.6	2.6	.2
5	Automotive equipment (include automotive mats).....	12b	2.3	(*)	3.1	.4	4.2	3.4	2.7
6	Household and appliance products....	12f	1.1	.....	1.0	.2	1.2	2.4	1.0
7	Mats and matting (exclude automotive mats).....	12n	.1	.....	.3	(*)	.8	.4	.2
8	Hard rubber products (including auto battery containers).....	12p	.6	.4	1.5	(*)	.1	.4	1.0
9	Other miscellaneous mechanical goods	12	2.5	.1	1.6	.7	8.8	17.7	2.2
10	Wire and cable.....	13	.7	.5	2.4	1.0	28.8	1.6	2.7
11	Rubber footwear.....	14	4.0	1.5	1.0	(*)	.3	.....	1.9
12	Heels and soles.....	15a	1.3	.8	5.1	.....	3.7	1.8	3.4
13	Inner shoe cushions and pads.....	15d	(*)	.3	.4	(*)	.8	(*)	.2
14	Cements for shoes and shoe welding..	15g,h	.2	3.5	(*)	(*)	2.1	.7	.3
15	Other shoe products.....	15b,c,e,f,i,j,k,l	.1	.5	.3	.....	.6	1.1	.2
16	Cements.....	16	.2	1.9	.2	.5	2.8	2.7	.4
17	Proofing, combining or coating of fabrics.....	17	.5	.4	1.0	.9	3.2	6.7	1.0
18	Drug sundries.....	18	1.4	6.3	.2	(*)	2.4	.8	.9
19	Floatation and life saving equipment	19,20	(*)	.1	(*)	.....	.3	(*)	(*)
20	Bullet sealing fuel cells.....	21	.4	.....	(*)	(*)	.2	8.6	.3
21	Athletic goods.....	22a	.2	(*)	.1	.2	.2	(*)	.1
22	Toys and balloons.....	22b, k	.3	4.1	.1	.....	.4	(*)	.3
23	Sponge rubber products & rubberized fiber & hair cushioning.....	22c, m	1.9	2.7	1.8	(*)	2.8	(*)	1.8
24	Pressure sensitive tape.....	22f	1.0	.1	.3	(*)	(*)	6.2	.5
25	Thread and related products.....	22h	1.0	3.0	.....	.....	.1	.....	.4
26	Rubber flooring and floor covering..	22L	(*)	.6	1.8	.....	.2	2.2	1.0
27	Other miscellaneous products.....	22	.6	.1	.5	.1	.4	3.6	.5
28	Latex foam.....	23	.1	57.1	1.6	.....	(*)	.....	3.2
29	All other rubber products.....	24	1.2	.8	.4	.2	2.1	9.9	.8
30	Total proposed consumption.....	.....	25.9	86.1	28.5	4.8	95.5	97.1	31.8

*Less than .05%.

Source: Summary of Forms NPAF-58 and NPAF-59.

Table IX, B(10).—COMPARISON OF 3RD QUARTER 1951 REQUIREMENTS OF NEW RHC AND RECLAIM AS REPORTED ON
NPAF-58 FOR TRANSPORTATION PRODUCTS

Item no.	Product description	Product Code No.	Total new RHC (lbs.)	Total reclaim (lbs.)	Reclaim	
					Percent to total new RHC	Average unit weight (lbs.)
	Tires:					
1	Airplane (large).....	1	2,133,794	11,124	.52	.26
2	Airplane (small).....	1	173,596	2,991	1.72	.10
3	Bicycle.....	1	1,116,486	1,730,814	155.02	.66
4	Motorcycle.....	1	92,389	25,924	28.06	2.14
5	Passenger thru (6.50) & (7.10).....	1	108,708,669	46,800,978	43.05	3.97
6	Passenger over (6.50) & (7.10).....	1	43,087,985	12,793,234	29.69	3.49
7	Industrial pneumatic.....	1	866,940	249,448	28.77	.98
8	Tractor implements (large).....	1	11,733,611	5,522,950	47.07	18.76
9	Tractor implements (small).....	1	4,312,430	3,438,939	79.74	4.89
10	Truck (7.50) and under.....	1	45,460,788	6,097,197	13.41	2.92
11	Truck (8.25) thru (9.00).....	1	48,526,709	1,739,088	3.58	1.47
12	Truck (10.00) thru (12.00).....	1	55,161,264	1,287,503	2.33	1.48
13	Truck over (12.00).....	1	14,966,096	82,660	.55	.98
14	Solids—Airplane.....	2	5,329	.....	.....	.....
15	Solids—bogies, idlers and support rollers	2	4,148,239	.....	.....	.....
16	Solids—pressed and cured on.....	2	2,459,498	692,436	28.15	1.36
	Tubes:					
17	Airplane.....	3	390,084	.....	.....	.....
18	Bicycle.....	3	870,484	298,308	34.27	.12
19	Industrial.....	3	163,006	26,084	16.00	.10
20	Passenger and motorcycle.....	3	19,389,372	2,240,018	11.55	.17
21	Tractor implements.....	3	2,544,283	289,672	11.39	.32
22	Truck (8.25) and under.....	3	6,348,443	701,129	11.04	.32
23	Truck (9.00) thru (13.00).....	3	7,274,812	921,227	12.66	.74
24	Truck (14.00) and over.....	3	877,833	23,590	2.69	.54
25	Valves.....	4	477,854	.....	.....	.....
26	Curing bags.....	4	1,891,190	16,040	.85	*.28
27	Tire flaps.....	5	4,625,551	888,599	19.21	*.71
28	Camelback (pounds).....	6	33,859,449	6,973,252	20.59	** 10.07
29	Other retread materials (pounds).....	6	2,323,538	46,091	1.98	** .90
30	Tire and tube repair mats. (pounds).....	7	1,781,949	523,118	29.36	** 13.11
31	Tank blocks, treads and band tracks (pounds)	8	4,168,044	.....	.....	.....
32	Master batches or compounds made for and/or sold to others (pounds).....	.....	7,281,646	684,989	9.41	.....
33	Total proposed consumption (items 1-32)	.....	437,221,411	94,107,403	21.52	.....
34	Consumption (un-allocated).....	.....	115,106,622	18,081,634	15.71	.....
35	Total proposed consumption.....	.....	552,328,033	112,189,037	20.31	.....

Item no.	Product description	Product Code No.	Total new RHC (pounds)	Total reclaim (pounds)	Percent reclaim to total new RHC
1	Belts and belting.....	9	10,348,941	4,264,882	41.21
2	Hose.....	10	15,247,918	16,120,711	105.72
3	Packing and gaskets.....	11	10,822,548	2,636,153	24.36
4	Aircraft equipment.....	12a	1,417,950	37,337	2.63
5	Automotive eqpt. (incl. automotive mats).....	12b	20,336,376	25,067,500	123.26
6	Household and appliance products.....	12f	7,426,981	2,909,289	39.17
7	Mats and matting (excl. automotive mats).....	12n	1,568,073	3,886,497	247.85
8	Hard rubber products (incl. auto battery containers)	12p	7,728,883	13,121,392	169.77
9	Other miscellaneous mechanical goods.....	12	16,829,321	11,208,392	66.60
10	Wire and cable.....	13	21,783,595	1,418,279	6.51
11	Rubber footwear.....	14	15,020,675	1,773,258	11.81
12	Heels and soles.....	15a	27,129,207	11,822,219	43.58
13	Inner shoe cushions and pads.....	15d	1,960,031	350,300	17.87
14	Cements for shoes and shoe welding.....	15g, h	2,390,164	2,000	.08

See footnotes at end of table.

Table IX, B(10).—COMPARISON OF 3RD QUARTER 1951 REQUIREMENTS OF NEW RHC AND RECLAIM AS REPORTED ON NPAF-58 FOR TRANSPORTATION PRODUCTS—Continued

Item no.	Product description	Product Code No.	Total new RHC (pounds)	Total reclaim (pounds)	Percent reclaim to total new RHC
15	Other shoe products.....	15b, c, e, f, i, j, k, l	1,767,590	56,300	3.19
16	Cements.....	16	3,428,964	3,510,776	102.39
17	Proofing, combining or coating of fabrics.....	17	7,891,905	1,286,220	16.30
18	Drug sundries.....	18	7,054,321	90,999	1.29
19	Flotation and life saving eqpt.....	19, 20	153,689	.....	.....
20	Bullet sealing fuel cells.....	21	1,817,200	237,800	13.09
21	Athletic goods.....	22a	1,068,757	172,723	16.16
22	Toys and balloons.....	22b, k	2,759,057	889,184	32.23
23	Sponge rubber prods. & rubberized fiber & hair cushion.....	22c, m	14,262,634	1,964,704	13.78
24	Pressure sensitive tape.....	22f	4,186,740	305,856	7.31
25	Thread and related products.....	22h	3,109,797	.....	.....
26	Rubber flooring & floor covering.....	22L	8,446,630	901,220	10.67
27	Other miscellaneous products.....	22	4,004,770	210,590	5.26
28	Latex foam.....	23	20,923,226	.....	.....
29	All other rubber products.....	24	6,474,186	3,574,852	55.22
30	Total proposed consumption (items 1-29).....	.....	247,360,129	107,819,433	43.59
31	Consumption (un-allocated).....	.....	9,820,780	4,442,050	45.23
32	Total proposed consumption.....	.....	257,180,909	112,261,483	43.65

*Excludes one company that reported on rubber but not units.

**Percent of total weight.

(d) Rubber Industry Requirements for Chief Non-Rubber Materials

The rubber manufacturing industry is a large user of non-rubber materials. The art of rubber manufacture is based primarily on rubber and compounding ingredients, and secondarily on textiles which are required for the production of a number of the more important products, such as cords for tire carcasses, duck for belting and hose, footwear cloth, and rubberized piece goods and clothing, with a large requirement for metals for tire beads, tire valves, hose couplings and parts, footwear buckles and grommets, and insulated wire.

An idea of the extent of use of representative materials is afforded by the data in table IX, B(7), compiled by the Priorities, Industrial Expansion and Components Branch of the Rubber Division, NPA, for materials under their jurisdiction. This table represents estimated requirements of various materials in a year when new rubber consumption is 1,274,000 long tons (of which 462,000 is natural rubber, dry and latex, and the remaining 812,000 consists of synthetic rubbers) and reclaimed rubber consumption is 319,000 long tons. The estimates assume a production of 20,400,000 truck and bus tires, 71,000,000 passenger and motorcycle tires, and 4,900,000 tractor and implement tires. Approximations of requirements at varying rates of consumption would change with the types of rubber used and with the relative production of the various products of the industry. In this particular calculation, it is assumed that 66 percent of the rubber consumption is in transportation products and 34 percent in non-transportation items. The estimates for certain basic chemicals required for the production of ingredients used in rubber manufacture, included in items 12(a) through 12(h) is in large part an amplification of the quantities shown under items 10 and 11. The cotton estimate is for the approximate tire requirements during the current year; because of lack of reasonably accurate data no estimate has been made for the cotton requirements for non-transport goods. The table indicates the principal uses in the rubber industry for each material listed, but there is a considerable use of additional and other components and materials not included in the tabulation.

C. FOREIGN COUNTRIES

In addition to the estimates in table IX, A(1) of total consumption of natural and synthetic rubber outside the United States, the relative importance of consumption in individual important countries is of interest. For most countries consumption is not reported, and we are dependent on estimates derived from their imports of natural rubber [table VII, A(1)]. Table IX, C(1) contains such consumption statistics as are reported, and aggregate estimates for other areas, covering both natural and synthetic rubber.

Table IX, C(1).—ESTIMATED FOREIGN CONSUMPTION OF NEW (NATURAL AND SYNTHETIC) RUBBER, 1946-50
[In 1,000 long tons]

Country	1946	1947	1948	1949	1950
United Kingdom.....	126.8	156.4	196.3	186.6	222.4
France.....	58.5	73.7	93.9	99.5	107.3
Germany.....	13.5	15.9	50.0	68.2	82.0
Netherlands.....	4.3	8.2	13.0	12.1	14.6
Russia ¹	9.5	35.0	100.0	105.0	82.5
Other Europe.....	59.2	109.7	133.1	² 161.7	³ 162.1
Australia.....	20.0	23.1	26.5	27.9	34.4
Canada.....	39.2	61.5	62.1	56.4	68.7
India.....	14.0	17.0	19.7	19.7	17.7
Brazil.....	16.1	14.2	15.7	19.0	22.5
Japan.....	20.0	17.1	26.6	34.2	62.6
China ¹	12.1	22.2	21.0	27.5	70.0
Other countries.....	43.0	58.7	75.2	80.8	79.6
Grand total.....	436.2	612.7	833.1	898.6	1,026.4

¹ Imports of natural rubber only, estimated.

² Including Italy 35.0, and Belgium 11.0.

³ Including Italy 40.0, and Belgium 11.0.

Source: Statistical Bulletin, International Rubber Study Group; and Rubber Division, NPA.

The United Kingdom is the leading foreign country for which statistics are reported, followed by France, Germany and Canada. Russia, Japan, China and Italy are other leading countries. The statistics for Russia and China shown in table IX, C(1) are their "estimated imports" of natural rubber; no domestically-produced rubber either synthetic or natural is included. China's imports increased sharply after the start of the Korean war in 1950.

The Russian consumption of natural and synthetic rubber is unknown. An estimate of 300,000 tons a year (say 75,000 natural and 225,000 synthetic) would perhaps be a liberal guess of their current annual rate of new rubber consumption. Russia probably ranks first, ahead of the United Kingdom, among foreign rubber consuming countries.

Note the large increase in Japan's consumption in 1950, partly due to Korean war orders supplied by manufacturers in Japan.

Some information on the consumption of rubber by types and by products is reported for certain foreign countries (Canada, United Kingdom, France) but this information in most cases would not be particularly significant for purposes of this study. In nearly all foreign countries except Russia and Canada, the consumption of synthetic rubber in the last few years has been very small.

However, in the case of the United Kingdom, the consumption of natural and of synthetic rubber in certain nontransport products in 1945 and 1946, when fairly large amounts of synthetic rubber were being used there, may be of interest (since similar details were not compiled for the United States) as indicating the nontransport fields in which GR-S was then mainly used. Table IX, C(2) provides these details.

Table IX, C(2).—UNITED KINGDOM RUBBER CONSUMPTION IN NONTRANSPORT GOODS—1945-46

[In long tons]

Goods	1945		1946	
	Natural	Synthetic	Natural	Synthetic
Belting.....	553	2,918	4,730	1,219
Cables.....	1,983	4,090	6,941	3,052
Ebonite.....	430	492	954	390
Footwear (including repairs).....	165	696	4,393	2,789
Soles and heels.....	.....	2,229	(¹)	(¹)
Hose.....	121	1,276	925	716
Proofing.....	54	988	1,103	467
Surgicals.....	320	236	526	43
Thread.....	115	391	1,294	23
Sponge.....	(²)	(²)	489	14
Balloons.....	120	194	(²)	(²)
Gas Masks.....	8	57	(²)	(²)
Self-sealing tanks.....	201	726	(²)	(²)
All other.....	2,145	5,203	10,984	3,954
Total.....	6,215	19,496	32,339	12,667

¹ Included in footwear.² Included in "all other."

Source: Secretariat of the Rubber Study Group.

The consumption of synthetic rubber in foreign countries, so far as data is available, is shown in table VII, B(1).

The consumption of reclaimed rubber is reported for few foreign countries. In Germany and France, there is a much larger percentage use of reclaim than in the United Kingdom or in British Empire countries except Canada. The use of reclaim was always officially discouraged in the United Kingdom up to the start of World War II, the effort of course being to promote the use of natural rubber to the utmost, since it was so largely produced in British possessions. The available statistics on foreign consumption of reclaim are shown in table IX, C(3).

Table IX, C(3).—CONSUMPTION OF RECLAIMED RUBBER IN CERTAIN COUNTRIES, 1945-50

Year	United Kingdom	Australia	Canada	Germany
1945.....	26,708	5,454	15,313	(¹)
1946.....	25,288	7,090	14,140	(¹)
1947.....	22,509	5,601	16,322	(¹)
1948.....	23,507	5,846	13,686	(¹)
1949.....	20,241	6,163	11,791	21,872
1950.....	24,999	8,173	13,952	21,115

¹ Not reported.

Source: Secretariat, Rubber Study Group.

X

Rubber Prices

X

Rubber Prices

A. NATURAL RUBBER

In the everyday commercial lives of those associated with the rubber trade and the rubber manufacturing industry, the price of natural rubber has been a paramount consideration at all times. Historic events have assumed importance and are remembered in relation to their effects on rubber prices. Table X, A(1), which shows the annual high, low, and average prices of No. 1 Ribbed Smoked Sheets from 1920 through 1950, would serve as an outline of rubber history and personal biography to any individual who has been connected with the rubber industry throughout the period.

Variations from low to high in each year (except the 1942-46 period of government control of all sales at a fixed price) have been wide, averaging 128 percent in the 1920-29 decade, 102 percent in the 1930-39 decade, and 98 percent in the subsequent years (omitting 1942-46). After the advent of our chemical rubber industry, the price variations in natural rubber were less extreme until 1950, averaging only 46 percent in 1947-49. The importance of the price of natural rubber in the lives of American citizens is waning.

The table starts with the decline in price following the short boom after World War I, bringing prices to a low of 11 1/2 cents at the pit of the 1921 trade depression, and setting the stage for the Stevenson (British) Restriction Scheme of November 1922-October 1928.

Under that scheme, prices were bid up at its introduction, then a lull occurred and prices declined although stocks were declining until mid 1924, then a shortage of rubber pushed prices in 1925 to the highest level ever quoted since plantation rubber became the chief source of supply. Increased use of reclaim, relaxation of the restriction on exports of rubber from Malaya and Ceylon, and increased production in the Netherlands Indies gradually corrected the shortage, but the pivot price under the scheme was in 1926 upped to 42 cents compared with 30 cents previously. The new pivot price supported by increased British restriction tended to hold the market level high, but further stimulated the output in non-British producing areas, causing serious decline in the British share of the world trade in rubber. The British endeavored to enlist the Dutch in the restriction scheme. That failing, they announced early in 1928 that the scheme would terminate at the end of October, and rubber quotations dropped promptly and sharply.

Table X, A(1).—NO. 1 RIBBED SMOKED SHEETS—SPOT CLOSING PRICES—1920-50

[New York market—cents per pound]

Year	High	Low	Average	Year	High	Low	Average
1920.....	56 1/2	16	36.30	1936.....	23	13 1/2	16.41
1921.....	21 3/4	11 1/2	16.36	1937.....	26 7/8	14	19.39
1922.....	28 3/8	13 5/8	17.50	1938.....	17 3/16	10 1/4	14.64
1923.....	37 1/8	24 3/4	29.45	1939.....	24	14 15/16	17.57
1924.....	40 1/8	17 5/8	26.20	1940.....	24	18 1/4	20.10
1925.....	121	34 3/8	72.46	1941.....	24 7/8	19 1/8	22.40
1926.....	88 1/2	36 3/4	48.50	1942.....	22 1/2	22 1/2	22.50
1927.....	41 3/4	33	37.72	1943.....	22 1/2	22 1/2	22.50
1928.....	41 1/4	17	22.48	1944.....	22 1/2	22 1/2	22.50
1929.....	26 7/8	15 1/2	20.55	1945.....	22 1/2	22 1/2	22.50
1930.....	16 1/2	7 1/2	11.98	1946.....	22 1/2	22 1/2	22.50
1931.....	8 5/8	4 1/4	6.17	1947.....	25	14	20.00
1932.....	4 3/4	2 1/2	3.49	1948.....	25	18	21.99
1933.....	9 7/8	2 7/8	5.96	1949.....	19 3/4	15 7/8	17.57
1934.....	15 7/8	8 3/4	12.92	1950.....	86	18	41.10
1935.....	13 3/4	10 1/2	12.37				

Source: Rubber Age.

During the world trade depression of 1929-33 the price declined steadily as accumulating stocks clogged the markets, but conditions had passed their worst when, in 1933, the spadework was well underway on the International (British, Dutch, French, and all Far Eastern rubber-producing countries) Rubber Regulation Scheme introduced in June 1934. The price pattern for the next three years was much the same as in 1922-25—a spurt, then a decline, then a peak in early 1937. The 1938 recession in American business caused prices to decline and brought more severe curtailment of natural rubber production, which was reducing supplies and pushing prices upward at the start of World War II in 1939.

Arrangements for U. S. Government stockpiling, and price agreements made with the British and the Rubber Regulation authorities in consequence, were controlling market factors during 1940-41. This was followed by the 1942-46 period of fixed prices. After the resumption of free trade in rubber April 1, 1947, the American industry did not have to pay high prices for natural rubber until the new rubber supply got out of balance with demand in 1950, partly because of under-estimates of demand by industry, partly (let it be admitted) because of Government overall mismanagement of rubber affairs, and partly because of the war in Korea which was not foreseeable.

In 1951, the price has receded to around 50 cents a pound. This price is still fantastically high in relation to 1947-49 prices, even making all proper allowance for inflation. A major readjustment must be made when our stockpiling terminates unless the flow of natural rubber supplies is greatly reduced by some cause.

The GSA buying price, under current conditions, establishes the world price level for natural rubber. Any other buyer can secure desired tonnages by outbidding GSA a fraction of a cent per pound; any seller can depend on GSA to buy whatever he cannot sell elsewhere. This will remain true only so long as the United States continues to buy all natural rubber offered; it must end when the stockpile goal has been achieved, if not sooner.

Table X₁ A(2) covers prices of crude rubber from 1900 to 1920. In the first years of this century, Para rubber (wild) from Brazil was the standard, and until 1910 records available show only the annual high and low prices for wild Para and for plantation smoked sheets from Ceylon. Thereafter, the average annual prices for plantation ribbed smoked sheets are a matter of record. Prices of rubber showed a strong rising trend from 1900 to 1910 when the all-time high quotations were recorded, thereafter to 1919 the price declined as increased supplies of plantation rubber more fully supplied world needs, despite the retarding effect of the first world war. In 1920, the start of the post-war trade depression brought a serious fall in the price of rubber, as it did in commodity prices generally, paving the way to the British (Stevenson) Restriction Scheme described elsewhere.

Table X₁ A(2).—NEW YORK SPOT RUBBER PRICES 1900-1920

[Cents per pound]

Year	Upriver Fine Para		Plantation Ribbed Smoked Sheets			Year	Upriver Fine Para		Plantation Ribbed Smoked Sheets		
	Low	High	Low	High	Average		Low	High	Low	High	Average
1900....	89	110	(¹)	(¹)	(¹)	1910....	136	292	141	288	206.60
1901....	83	94	(¹)	(¹)	(¹)	1911....	92	168	114	184	141.30
1902....	70	91	(¹)	(¹)	(¹)	1912....	102	123	108	140	121.60
1903....	84	109	(¹)	(¹)	(¹)	1913....	71	110	59	113	82.04
1904....	94	131	(¹)	(¹)	(¹)	1914....	63	115	56	93	65.33
1905....	118	135	(¹)	(¹)	(¹)	1915....	55	87	58 1/2	79	65.85
1906....	122	129	86	150	(²)	1916....	62	99	55	102	72.50
1907....	82	124	93	138	(²)	1917....	54	80	52	90	72.23
1908....	66	130	75	130	(²)	1918....	56	70	40	70	60.15
1909....	120	215	128	208	(²)	1919....	47	61	38 1/2	57	48.70
						1920....	18	50	16	56 1/2	36.30

¹ Not regularly quoted. ² Average not available.

Source: "Marketing of Crude Rubber," Department of Commerce, 1927.

Table X, A(3) shows monthly New York market prices for No. 1 Ribbed Smoked Sheets for recent years. Separate 1951 quotations show that selling prices of the General Services Administration have varied considerably from equivalent world prices which is of course quite abnormal. GSA has on hand a considerable tonnage of rubber below stockpile quality which has been bought on the high market prevailing since the start of the Korean war.

Table X, A(4) gives the monthly declared value per pound of United States total imports of natural rubber. These values indicate the international exchange involved in our imports. The price of No. 1 Sheet used in the two preceding tables is the quotation generally used to show market variations; there is no record of composite average market price for all types of natural rubber; the composite price would be appreciably lower than No. 1 Sheet, since off-grades sell at varying discounts, and account for the bulk of the rubber.

Table X, A(3).—MONTHLY AVERAGE—NEW YORK SPOT PRICE—NO. 1 RIBBED SMOKED SHEET, 1947-51

[Cents per pound]

Month	1947	1948	1949	1950	1951	1951 ¹	1951 ²	Month	1947	1948	1949	1950	1951	1951 ¹	1951 ²
January..	24.7	21.8	19.2	18.4	71.2	.....	66.9	August....	15.2	23.6	16.6	51.6	....	49.6	52.0
February	25.8	20.4	18.5	19.4	73.6	.....	66.0	September	16.5	22.9	17.6	56.1	....	53.5	52.0
March...	25.8	20.3	19.1	19.9	71.8	.....	66.0	October...	20.4	22.1	16.3	62.6	....	52.3	52.0
April...	24.4	23.0	18.5	23.7	....	67.3	66.0	November..	23.6	20.5	16.7	73.1	....	49.1	52.0
May.....	21.0	23.4	17.9	28.4	....	54.3	66.0	December..	21.5	18.9	17.6	71.2	....	.....	52.0
June....	16.3	22.8	16.3	30.8	....	50.7	66.0	Year.....	20.8	22.0	17.6	41.2	....	.....	59.0
July....	15.5	24.2	16.5	40.2	....	48.6	52.0								

¹ Singapore price, nearby rubber, c.i.f. New York.

² G.S.A. selling price.

Source: Calculated from Commodity Exchange Daily Reports.

Table X, A(4).—MONTHLY DECLARED VALUE OF UNITED STATES NATURAL RUBBER IMPORTS 1947-51,
(DRY RUBBER, LATEX AND GUAYULE)

[Cents per pound]

Month	1947	1948	1949	1950	1951	Month	1947	1948	1949	1950	1951
January.....	24.4	17.4	18.3	15.2	48.8	August.....	16.8	18.6	15.5	25.0	48.1
February....	23.8	18.4	17.6	15.8	51.3	September....	14.4	19.7	14.8	30.0	43.4
March.....	24.7	18.4	17.1	16.7	52.6	October.....	14.5	20.3	15.0	33.8	42.7
April.....	23.2	17.9	17.1	17.1	53.7	November.....	15.8	20.1	14.9	41.6	.....
May.....	23.0	17.9	16.7	17.6	54.6	December.....	16.1	19.3	14.9	46.0	.....
June.....	20.6	18.4	16.7	19.4	54.7	Year.....	20.0	18.8	16.2	25.5	.....
July.....	18.3	19.0	16.1	21.7	53.2						

Source: Calculated from official U. S. import statistics, Bureau of the Census.

The import values, which cover all the types and grades, indicate that in ordinary years the difference would not be serious but in 1950 and 1951 the off-grades have been selling at far greater discount than normally. The trend of import values, representing a composite of contracts made mostly several months earlier, lags behind the trend of spot market prices.

B. SYNTHETIC RUBBER

The price of our synthetic rubber is not like that of natural rubber subject to the higgling of the market, but is determined by the Government.

It is the well established policy of our Government that selling prices of Government-produced synthetics shall cover their costs. This has included plant equipment amortization figured on a twelve-year life, which is understood to be comparable with the practice in chemical industries.

The practice has also been to sell GR-S at a uniform price. The higher costs of production from alcohol-based butadiene are averaged with the lower costs from petroleum-based butadiene. Some copolymer plants produce more efficiently than others, but they are all averaged together. A large expense was entailed to convert copolymer plants to the production of cold rubber, but its selling price has been identical with that for the high temperature GR-S at any stated date. Incidentally, the Government applies a uniform charge for transportation costs, regardless of the destination, length of haul, etc.

Table X, B(1) gives the history of selling prices charged for Government-produced GR-S, Butyl, and Neoprene up to the time the Neoprene plant was sold to du Pont. The dates of all price changes are listed.

Table X, B(1).—U. S. GOVERNMENT SELLING PRICES FOR SYNTHETIC RUBBER, 1942-51

[Cents per pound]

Date	Chemical rubber			Natural rubber	Date	Chemical rubber			Natural rubber
	GR-S	Butyl	Neoprene			GR-S	Butyl	Neoprene	
July 1941.....	.....	.....	.....	22 1/2	Jan. 13, 1947...	³ 18 1/2	³ 18 1/2	³ 27 1/2	³ 25 3/4
Oct. 1, 1942....	50	33	65	22 1/2	June 21, 1947...	18 1/2	18 1/2	27 1/2	⁴ 23
April 1, 1943 ¹ ..	² 18 1/2	² 15 1/2	45	² 22 1/2	Aug. 1, 1947....	18 1/2	18 1/2	⁵ 32	23
July 10, 1943...	² 18 1/2	² 15 1/2	² 27 1/2	² 22 1/2	Dec. 7, 1950 ⁶ ...	24 1/2	20 3/4	.....	.....
Sept. 1, 1945...	18 1/2	15 1/2	27 1/2	22 1/2	Sept. 1, 1951...	26	20 3/4	.....	.....
March 1, 1946...	18 1/2	18 1/2	27 1/2	22 1/2					

¹ A uniform freight charge of 1/2¢ per pound on carload lots, 1¢ per pound less carload, was made applicable. Before April 1, 1943, sales were f.o.b. point of shipment.

² In addition 17 1/2¢ for rubber used in supplying military orders was paid by the Army & Navy, until Sept. 1, 1945.

³ On January 31, 1947, the freight charge was increased to 0.75¢ carload and 1.2¢ less carload.

⁴ The date for manufacturers who had already purchased their quotas. Effective July 16 for all manufacturers.

⁵ This Neoprene price effective until December 31, 1949.

⁶ Uniform freight charge upped to 1¢ carload and 1.6¢ less carload.

Source: General Services Administration.

It will be noted that there have been two price increases for GR-S since the start of the Korean war. Costs were increased by the expenses of rehabilitation of idle plants, the increased use of alcohol in the production of butadiene, the higher costs of production in the less-efficient stand-by plants, the conversion of GR-S plants to the production of cold rubber, the necessity of contracting for supplies of styrene in addition to the quantities for which rights were reserved when the styrene plants were disposed of to private industry, and by higher labor costs.

If and when our production of GR-S again is supplied from petroleum-based butadiene, and the much higher cost alcohol butadiene is eliminated, a reduction in the price of GR-S is to be expected.

Butyl was priced lower than GR-S until March 1, 1946. From that date to December 7, 1950, Butyl and GR-S prices were uniform; the 1946 increase in the selling price of Butyl, however, was made to offset certain non-Butyl costs, and was opposed at the time by members of the rubber industry. The cost of Butyl was not subject to the alcohol-butadiene factor, nor affected by the GR-S plant conversion to cold rubber, and the pattern of a uniform GR-S and Butyl price has apparently been abandoned.

For the sake of completeness with respect to RFC rubber prices, their selling prices for No. 1 Sheet natural rubber are included in the table to August 1, 1947.

C. RECLAIMED RUBBER

Reclaimed rubber prices have been increased since before the war chiefly because of higher costs of scrap rubber due to rising costs of labor and transportation. First grade whole tire reclaim at the start of the war was selling at 6 cents a pound. The price crept up gradually to 8 cents for 1947, rose to 9 cents in June 1950, and to 10 1/2 cents in September 1950, where it remained during the first half of 1951.

XI

Organizational Facilities



XI

Organizational Facilities

A. UNITED STATES GOVERNMENT

Since the end of fighting in World War II, the United States Government has continued to concern itself in the rubber business of our country and of the world.

Major policy has been influenced by the Baruch Committee 1942 Report and Recommendations on Rubber, by the 1946 Recommendations of the (Batt) Interagency Rubber Policy Committee, by the Strategic and Critical Materials Stockpiling Act (P. L. 520, 79th Congress), by the declaration of policy by Congress in the Rubber Act of 1948, and by the Steelman Report on Synthetic Rubber to the President and Congress in January 1950. There have been several additional reports on special subjects by Interagency Task Groups. The objectives are, in brief, to maintain and support a nucleus domestic synthetic rubber producing industry, with the balance of the plants either operating to supply voluntary consumption requirements or, lacking these, kept in readiness for use in an emergency, to stockpile natural rubber necessary for use in any emergency when imports are cut off, but at the same time so to conduct our rubber affairs as to maintain and build goodwill among foreign nations interested in natural rubber production and minimize any harmful effects on natural rubber producers. Since the termination of the wartime Office of the Rubber Director, the executive authority and jurisdiction over rubber matters has rested with the White House.

The production of Government synthetic rubber has continuously been under the jurisdiction of the Reconstruction Finance Corporation. The determination of the natural rubber stockpiling objective and of quantities to be purchased during specific periods is a function of the Munitions Board. The control of domestic rubber consumption has in recent years been exercised by the Department of Commerce, currently through the National Production Authority. The procurement of natural rubber for the stockpile, and during 1951 the jurisdiction over all imports of natural rubber, has been placed in the hands of the General Services Administration, in the Emergency Procurement Service. Any and all negotiations and conferences with representatives of foreign Governments on rubber matters are carried on under the aegis of the Department of State. The Department of Agriculture carries on experimental work in the domestic production of natural rubber, and furnishes technical assistance under the Cooperative Agreements with Latin American Governments interested in developing Hevea plantations.

B. UNITED STATES INDUSTRY

In relations with domestic industry, several of these agencies have the assistance of industry committees. The Munitions Board has both a Government Rubber Committee and an Industry Rubber Committee, NPA, a Rubber Industry Advisory Committee, State, a Rubber Advisory Panel, etc. The industry committees of various agencies have several duplications in membership, but also numerous variations depending upon the particular field in which the group must be prepared to offer advice; a single industry committee to serve all agencies has not been deemed practical.

The central organization of the manufacturers of rubber products is the Rubber Manufacturers Association, Incorporated. This association has headquarters at 444 Madison Avenue, New York 22, N. Y., and a Washington branch office. The association is organized in divisions by classes of products, and its advice is usually sought on all rubber and rubber product problems.

The rubber importers and dealers are organized in the Rubber Trade Association of New York, with headquarters at 15 William Street, New York 5, N. Y., and a Washington office. They render valuable assistance on matters relating to international trade in natural rubber and international relations in this field.

Rubber reclaimers have their separate Rubber Reclaimers Association, Inc., with headquarters at 250 West 57th Street, New York 19, N. Y.

The above are the principal organizations of the industry; the naming of less important groups would seldom be helpful. In matters relating to the prices and

collection of scrap rubber tires, etc., the National Association of Waste Material Dealers, Inc., 271 Madison Avenue, New York 16, N. Y., would be involved. In matters relating to distribution of tires and automotive rubber goods, the National Association of Independent Tire Dealers, Inc., 631 Pennsylvania Avenue, N. W., Washington 4, D. C., usually has suggestions to offer.

C. FOREIGN COUNTRIES

Outside the United States, in matters relating to rubber, the State Department operates through diplomatic channels with individual Governments, or through an accredited Delegate at annual Meetings of the International Rubber Study Group.

The most important rubber industry organization abroad is the Rubber Growers Association, 19 Fenchurch Street, London, E. C. 3, England, whose members include most of the leading producers of estate rubber in Far Eastern countries. In prewar years, they were highly influential in British rubber policy, but since the war their influence has been less pronounced although still a matter of consideration. The Rubber Trade Association of London, in its activities and influence in England, roughly parallels the position of our Rubber Trade Association of New York.

The production of synthetic rubber by the Canadian Government is carried on by Polymer Corporation, Ltd., Sarnia, Ontario. They distribute in the United States through H. Muehlstein and Co., Inc., 60 East 42nd Street, New York 17, N. Y., who happens also to be the leading dealer in scrap rubber in the United States.

There are a few huge rubber manufacturing companies that need special mention. In our own country we have the Big Five—Firestone, General, Goodrich, Goodyear, and U. S. Rubber—whose activities as operators of copolymer GR-S plants and as manufacturers of rubber products in numerous domestic factories involves them in every Government decision of moment.

It is not always remembered that these American companies account not only for nearly two-thirds of the United States consumption of rubber, but also possibly half of the consumption of rubber outside the United States (except Russia) in their branch factories or affiliated companies. The British Dunlop Company, the French Michelin, and the Italian Pirelli are the most important foreign rubber manufacturing companies.

The extent of company concentration in the production of tires throughout the world is little realized. Outside the United States and iron curtain countries, most of the production is in the hands of a very few companies. In table XI,C(1),p. 3 is shown the distribution of factories for ten companies, by countries. In the headings, American companies are listed alphabetically, followed by foreign companies. Countries are listed alphabetically under a geographical arrangement. While most of the factories specialize in tires, other rubber goods are also produced, while the U. S. Rubber Company factory in Cuba specializes in rubber-soled shoes.

The location of all American plants of all rubber manufacturing companies is stated in the Rubber Red Book, mentioned in the Bibliography section.

Table XI, C(1).—FACTORIES OF CHIEF COMPANIES, BY COUNTRIES

Country	Dayton	Fire-stone	General	Good-rich	Good-year	Seiber-ling	United States	Dunlop	Mich-elin	Pir-elli
Canada.....	A	A	A	A	A	A	A	A		
Cuba.....				A	A		B			
Mexico.....			A	A2	A		A			
United States.....	(A)	(A)	(A)	(A)	(A)	(A)	(A)	A		
Argentina.....		A			A		A1		A	A1
Brazil.....		A	A4		A			A4	A4	A
Chile.....			A							
Colombia.....					A		A			
Peru.....					A					
Uruguay.....				A3						
Venezuela.....			A							
Belgium & Luxembourg.....					A				A	A
Eire.....								A		
France.....				A3				A	(A)	
Germany.....			A3					A		
Italy.....			A3						A	(A)
Netherlands.....				A2					A	
Portugal.....			A							
Spain.....		A							A	A
Sweden.....		A			A		A3			
Switzerland.....		A	A3							
United Kingdom.....		A			A			(A)	A	A
Australia.....					A			A		
India.....		A						A		
Indonesia.....					A					
Israel.....	A		A							
Japan.....				A2	A3			A		
New Zealand.....		A		A3				A		
South Africa.....		A	A		A			A		

A Tire factory.

(A) Parent company.

A1 U.S. and Pirelli jointly.

A2 Financial interest.

A3 Technical agreement.

A4 Planned.

B Footwear.

In some countries, Dunlop and Goodyear make tires for each other.

XII

Government Controls and Experiences

XII

Government Controls and Experiences

A. WORLD WAR II

Because of the outstanding strategic importance of natural rubber to our country before our development of synthetic rubber, representatives of the rubber industry were called into conference by our Government in many instances in the years between World Wars I and II. The controls over natural rubber production by foreign powers had necessitated cooperation between the U. S. rubber industry and our Government in dealing with the problems that arose from time to time. As a result, an excellent liaison existed between the industry, and the Departments of State, Commerce, and Justice, and after 1939 with the Munitions Board and the Reconstruction Finance Corporation in their rubber stockpiling activities. Usually negotiations with the industry involved officials of the Rubber Manufacturers Association, who enlisted the aid of representative industry personnel qualified to advise on the particular subject of discussion.

With the conquest of France by Germany in June 1940, consideration was given both to increasing the production of natural rubber in the countries of the Western Hemisphere (conference called by the Secretary of Agriculture) and to the establishment of a domestic synthetic rubber production (conferences held by the Reconstruction Finance Corporation which was already stockpiling natural rubber and was soon to assume jurisdiction over all imports of the commodity). About the same time, RMA officials were chosen to advise the President's National Defense Advisory Commission on rubber matters. Stimulation of domestic production of reclaimed rubber; Government licensing of exports of natural rubber, reclaimed rubber and scrap rubber; and domestic production of Guayule rubber were among other subjects considered, along with methods of conservation in the consumption of rubber.

With the establishment of the Office of Production Management, a nucleus Rubber Branch of OPM was constituted, headed first by RMA personnel, and later by one Branch Chief after another as OPM was succeeded by the War Production Board. OPM efforts in early 1941 were in the direction of a voluntary control of rubber consumption, which was ineffective. The rubber industry was shown to be clearly incapable of self-regulation of rubber consumption under the semi-emergency conditions during the first half of 1941. On June 21, the Government took full control of the trade in crude rubber effective June 23, and announced federal regulation of rubber consumption starting July 1. The control over crude rubber consumption was the first imposed by the OPM Division of Priorities over a commodity in which a shortage did not exist at the time.

Meanwhile, the restrictions on production of natural rubber in the Far East had been reduced by RFC-State Department arrangements with the British Government and the International Rubber Regulation Committee. American imports and stockpiling of rubber were accelerated, particularly in 1941, at the end of which the record amount of 534,000 tons of natural rubber was on hand in this country.

The June 1941 control order made consumption of both natural and synthetic rubber subject to allocation, with a descending percentage of base period (year ended March 31) consumption allowable each month from July through December, and required deliveries under Defense Orders in advance of other deliveries of rubber products. Sometime during the six months, there was drafted a detailed rubber control order that would become effective if we entered the war.

Synthetic rubber plant planning, while constantly under study, lagged until the Japanese attack on Pearl Harbor, and the situation then facing our country rubber-wise called for so much larger an undertaking than had previously been contemplated that several months were required to get the program agreed upon, and the construction under way.

The complexities and details of Government rubber activities, and the overlapping authorities, conflicts over materials, and lack of coordination among different agencies, was a matter of great difficulty in 1941 and 1942. A rubber Coordinator

was appointed in early 1942 but without plenary directive power and was therefore ineffective. In August 1942, the President appointed the Baruch Committee to survey the rubber situation and submit recommendations. In general, the steps that had been taken up to that time were endorsed (but castigated for tardiness), and the Committee recommended appointment of a Rubber Director with plenary authority to end squabbling between agencies, and to "bull the synthetic rubber program through."

Presidential appointment of the Rubber Director in November resulted during 1943 in gradual clarification, definition, and agreement on the authority and responsibility of each agency concerned with rubber. The Office of the Rubber Director, as responsible head of the entire rubber program, continued in being throughout the War. The need for such a directive head for rubber with delegation of authority and straight-line reporting responsibility among the agencies, was the principal organizational lesson learned in rubber in World War II.

During the war, natural rubber procurement from overseas was assigned first to the Office of Rubber Reserve in RFC, then to its subsidiary the Rubber Development Corporation, where it rested until April 1, 1947. Procurement in the countries of tropical America was arranged for under "Rubber Agreements" between the United States Government and the Governments of the rubber-producing countries, and these agreements involved U. S. commitments to provide these countries with an equitable share of required rubber goods. On the whole, these treaties were favorable to the United States; operations resulted in procurement of about 95,000 tons of new rubber up to the end of 1944—just about the amount then remaining on hand in the United States; without it we would have been without natural rubber during the Battle of the Bulge. The producing countries suffered restrictions on their supply of rubber goods that in most cases (except in Brazil and Mexico) were equally severe with those borne by civilians in the United States. Since the War, in several of these countries, the rubber manufacturing industry has been expanded or newly established, their needs for rubber products have about trebled, and it is highly questionable whether an appreciable quantity of natural rubber could be obtained from them by the United States if supplies from the Far East were again cut off in the near future.

The problem of provision of rubber for consumption was met, after Pearl Harbor, by drastic conservation, by maximum use of reclaimed rubber whenever possible, by use of synthetic rubbers as rapidly as they became available, and by guarding and husbanding our supplies of natural rubber to the utmost, top grades in particular. The conservation measures included the elimination from production of items that were not essential, the collection and rationing of surplus tires held by distributors and private motorists, increasing camelback (from reclaim and synthetics) output and tire retreading, the rationing of gasoline to reduce the use of motor vehicles and wear of tires, the cessation for some time of passenger car and passenger car tire production, speed limits for motor vehicles, car pools, etc. A national campaign for the collection of scrap rubber in mid-1942 resulted in a round-up of scrap supplies that carried the reclaimers through the war. Toward the end of and immediately after the war, with the assistance of an allocations board known as the Combined Rubber Committee (U. S. chairman; British, Canadian, Dutch, Belgian and French members), we were exchanging our synthetic rubber for natural rubber from our Allies, with mutual benefits.

Our consumption of rubber materials had to be limited to the supplies available. The military, naval, other essential government, and essential civilian requirements had to be satisfied. Advance estimates were required from claimant agencies; these were screened, and then reductions for those services deemed least essential were made to the extent necessary to keep within the limits of materials. The impression that the advance estimates were often padded and not very reliable still persists—this problem is likely to be a headache in any future similar set of conditions.

Conservation of natural rubber came to be governed by product specifications limiting its use. Specification control was demonstrated to be effective, and in general industry cooperation in such control was good; the cases for non-compliance were not too numerous, although there were some serious infringements and overconsumption that had to be penalized.

As supplies of synthetic rubber and other materials became ample to permit, the manufacture of passenger cars and passenger car tires was resumed, and from time to

time, the rationing of gasoline and tires and other restrictions on use of vehicles, speed of driving, etc., were reduced and finally eliminated.

B. POST WORLD WAR II

In 1944, Allied successes in the War made it possible to predict that it would end in our favor. This raised important questions with regard to the post-war rubber situation. The production of natural rubber in 1941 had been 1,600,000 tons; the 1944 production of synthetics in the United States and Canada was 800,000 tons; the record world consumption of new rubber had been 1,312,500 tons in 1941. If after the War the Far Eastern production was fully rehabilitated and the production of synthetic rubber was maintained at capacity, there would clearly be a glut of rubber. This situation was brought to the attention of our Government by the British, and representatives of the two Governments discussed the situation briefly in London in mid-1944. This led to the formation of the Rubber Study Group, which held its first meeting at Washington in January 1945, comprised of American, British and Dutch delegations. Since then meetings have been held about once a year, and the membership has grown to fifteen nations.

The Rubber Study Group has been a forum for discussion of the international rubber situation. The progress in production and consumption, the problems of each country, and the outlook for a year in advance are covered in the papers presented and in the discussions and committee meetings. The Group has been a means of keeping member Governments better informed concerning world rubber developments, both through its meetings and the Rubber Statistical Bulletin issued monthly by its Secretariat, which is recognized by the United Nations as the international statistical authority on rubber.

Each member of the Group is represented at meetings by a single official Delegate, who chooses Advisors from both industry and Government to accompany and assist him. In the case of the United States, the Delegate has always been from the Department of State. Until July 1947 the Group had power only to discuss, and each Delegate reported back to his own Government. Since 1947, the Group also has authority to submit joint recommendations, but these are not binding on Member Governments. Russia has never joined the Group, but has kept in touch with its discussions through satellite nations which were Members.

Through these meetings and the resulting liaison between Governments on rubber matters, our Department of State is well informed on the difficulties and troubles of natural rubber producers in the Far East. It is keenly aware of the fact that, since our synthetic rubber industry is Government-owned and our rubber consumption Government-controlled, it is easier for those interested in natural rubber production to think of their troubles as a result of the synthetic rubber program and activities of our Government than to consider them the result of an economic development that was bound to occur under private if not Government finance, or than to give due credit to our State Department for its powerful post-war voice in and influence on American rubber policy. The effort to mitigate and minimize action that might be to the detriment of those interested in natural rubber, has since 1948 been increasingly actuated by the desire to combat the spread of Communism as well as of anti-U. S. sentiment in Far Eastern countries.

Speaking from a rubber standpoint, the war period may be said to have ended with the initial expiration of the War Powers Act March 31, 1946. Since then the U. S. controls over rubber have been exercised under: (1) the one-year extension of the War Powers Act; (2) the Special Act of Congress (Public Law 24, 80th Congress) until March 31, 1948; (3) the Rubber Act of 1948; and (4) the Defense Production Act of 1950. Public Law 24 also ended the centralized Government imports of natural rubber, permitting private imports starting April 1, 1947.

Our Government continued to take some rubber under outstanding contracts with a few Latin American Governments until their termination. In mid-1947, Government stocks were set aside as a strategic stockpile, and since then information concerning the tonnage is classified as "Secret" although the approximate figure can be calculated at any time from other published data, and so is generally known. With the adoption of a strategic stockpile goal, the program for its attainment and maintenance through purchases and rotation of stocks was placed under jurisdiction of the General Services Administration.

The control over consumption passed from the Office of the Rubber Director to the War Production Board, and thence through the Civilian Production Administration and the Office of Temporary Controls in 1947 to the Department of Commerce, where it has since rested, and is presently vested in the National Production Authority. In general the tendency from 1946 to 1949 was to permit free total use of rubber and increasingly liberal use of natural rubber. When the war ended, the amount of natural rubber to be used was strictly limited; the regulations were subsequently changed to eliminate direct restrictions on the use of natural rubber and to require specific tonnage usage of GR-S and Butyl, in transportation rubber goods only after September 1947, until the outbreak of the war in Korea. The rubber manufacturing industry from 1946 through 1949 was constantly pressing for freedom of choice in the rubber materials to be used, so far as consistent with national security requirements. In response to industry representations and recommendations of some Government agencies in late 1949, although world free stocks of natural rubber had declined to a dangerously low point, control action liberalizing the use of natural rubber was taken as late as March 1950, when demand was rapidly being stimulated by growing international tension.

United States total consumption of new rubber had declined in both 1948 and 1949, and as a larger percentage of natural rubber was used, the tonnage of synthetics used declined steadily. Production of synthetics declined likewise, and as 1950 opened it stood at the lowest point since the War ended; stocks of synthetic also had declined considerably during 1949.

The war in Korea caused an abrupt change of rubber policy in the United States. Stockpiling of natural rubber was accelerated, its consumption restricted to permit stockpiling, the production and use of synthetics increased to replace the natural rubber put in the stockpile; since enough synthetics were not available to permit unrestricted consumption, total consumption was restricted.

The pattern of events just before World War II was in various respects duplicated. Exports of synthetic and natural rubber were already subject to license. The regulation of total consumption proclaimed in August 1950 was intended to reduce the tonnage consumed monthly during the remainder of that year. Priority for Defense Orders was decreed. The ending of private imports and placing jurisdiction over all imports of natural rubber in the General Services Administration on December 27 was necessary in case a world war should come, and also was designed to end competition between American buyers of natural rubber and aid in combatting the fantastically high prices at which natural rubber was then selling. Altered consumption regulations again limited directly the use of natural rubber; the stage of part-control of natural rubber consumption through specifications was reached in early 1951 and specification became the key control factor in the December 1951 order which removed the limits on total rubber consumption effective January 1, 1952.

C. INTERNATIONAL RUBBER CONTROL EFFORTS

• Because natural rubber production has been heavily concentrated in a few countries, which have not themselves been large users of the commodity, and because six to seven years is required from date of planting to bring new acreage into production, the possibility of controlling production so as to obtain higher prices for rubber than would prevail in a free market was too attractive to be resisted by producers and Governments of countries which derive benefit from profits on rubber production.

In the 1890's a Brazilian named Joaquin Vianna attempted to "bottle up the Amazon" in a monopoly of Para rubber, purely a private speculation which failed through lack of financing in the face of then rising competition from wild rubbers of African origin.

Brazilian Valorization

The Brazilian Valorization of Rubber was the first effort involving government aid.

Brazilian Federal Decree No. 979 of January 6, 1903, permitted organization of syndicates in agricultural and rural industries "for the defense of their interests," including the benefits of

cooperation, foundation of credit banks, and enjoyment of various favors from the Government, benefits to be participated in by Brazilians only. In late 1908 the legislative assembly of the State of Para approved a proposal to extend provisions of this decree to the rubber industry, authorizing formation of syndicates of merchants—producers of rubber—and calling for reduction in export duties on rubber exported by the syndicates. The Ranco do Brasil established agencies at Para and Manaus almost coincidentally, and on a steadily rising rubber market made substantial advances to Brazilian producers and dealers enabling them to hold rubber. Being practically a national bank, the effect was to afford Government aid to rubber producers. This led to consolidation of Brazilian rubber-producing interests (closely linked with the export firms at Para and Manaus), and 11 Brazilian houses sought to form a rubber syndicate in July 1909. The continued rise in rubber prices, and protests to Brazil from British and American trading interests through their respective Governments, influenced the State of Para against any definite reduction of export duties to this syndicate, but uncertainties attendant on these events contributed materially to the rubber speculation which continued until the price of the commodity exceeded \$3 per pound in April 1910. Syndicate operations were unequal to the task of supporting wild-rubber prices in the face of the advancing tide of plantation rubber and the attempt at rubber valorization was abandoned with heavy losses, being followed by an effort in 1912 by Brazilians to reorganize their rubber industry so as to continue effective competition with plantation rubber. The Federal Decree for this Defesa da Borracha is sometimes confused with the valorization incidents of which it was rather the consequence.

The high prices of 1909-12 brought such huge profits to the pioneer estate producers of rubber in Malaya, Ceylon and the Netherlands Indies that investment in rubber estates and the planting of rubber by smallholders was tremendously stimulated throughout Southeast Asia in succeeding years. It is significant that there was also significant progress in synthetic rubber research in the 1909-12 period, and during World War I, Germany produced small quantities of methyl synthetic rubber usable in hard rubber products.

The increased demand for rubber created by the development of the automobile industry in the United States and elsewhere prevented any serious overproduction until after World War I, and it might not have occurred then except for the 1920-21 world trade depression. The plantation industry from 1910 to 1920 was constantly improving methods and lowering costs of production. But the depression coincided with the coming into bearing of large areas of rubber planted in 1912-14.

Voluntary Restriction by Estates, 1920-21

In 1920, rubber prices fell rapidly, to less than 20 cents per pound for the first time and rubber producers in the Far East became apprehensive. Beginning November 1920, many rubber estates in Malaya, Ceylon, and the Netherlands Indies, who were associated in the Rubber Growers Association (London), entered into a voluntary cooperative agreement for the restriction of production. Although their production was definitely curtailed, the effect was offset by the decline which was occurring in world consumption, and also by the start of production from native holdings in the Netherlands Indies. After the first year this voluntary control petered out, as more and more of the estates refused to continue restricting production. At the same time, increased efforts were made by the Rubber Growers Association to obtain legislative restriction of rubber production by the Government.

Stevenson Restriction Scheme, 1922-28

On October 24, 1921, the British Colonial Office appointed the Stevenson Committee to investigate and report on the plantation rubber industry. The Committee reported in May 1922, and then for some months efforts were made to secure adherence to a restriction program by the Government of Netherlands and the Netherlands Indies. This was refused, however. Thereupon, the Committee issued a supplemental report, recommending restriction of output in Malaya and Ceylon alone. Upon endorsement by the Colonial Office, the Stevenson Restriction Scheme was adopted by the Governments of Malaya and Ceylon through legislation effective November 1, 1922, and which continued in force until November 1, 1928. A considerable number of British-owned plantations in the Netherlands Indies restricted production voluntarily to some extent in cooperation with the purpose of the control.

An assessment of individual estates and smallholders according to their ability to produce was provided for, and exportable percentages were declared quarterly after determination in accordance with a formula based on the London market price

for rubber. Export coupons were granted to producers which amounted to licensing exports of rubber and thus indirectly restricting production and trade. The Stevenson Scheme did restrict; it also raised the price of rubber, and in 1925 the limitation of production in a period of high demand, coupled with speculation and inherent faults in the structure of the Scheme, pushed rubber prices above \$1.20 a pound in New York. But the success of the control stimulated the production in countries where the Scheme was not in effect, and particularly by natives in the Netherlands Indies whose capacity had been badly underestimated, and the restriction area each year was having to curtail its output more severely and supplying a smaller percentage of the total world production, losing its monopoly. Meanwhile, in the United States and some other countries, use of reclaimed rubber was greatly increased, retarding the demand for new rubber. Furthermore, there was bitter U. S. Congressional criticism of the Scheme as a means of exploiting the American public. When it became apparent that continuation of the Scheme in the British Colonies alone was unworkable, renewed efforts were made to gain Dutch adherence. This was again refused, and at the end of 1927 the British Government announced that the control would be terminated effective November 1, 1928.

During the Stevenson Restriction Scheme period, there was further stimulation to synthetic rubber research, although not much was heard about it at the time. In the United States, the du Pont interests, Standard Oil, and some rubber manufacturing companies engaged in independent private research in this field. It is significant that despite the low prices which prevailed for natural rubber during the 1930-35 period, it was during this time that modern Russian and German synthetic rubbers, and American Neoprene and Thiokol came into the field of general knowledge.

International Rubber Regulation Agreement

The proponents of rubber restriction learned several things from the Stevenson Scheme experience. They learned that a successful restriction scheme would need to cover virtually all producing countries; that to be a long-term success, a restriction plan would need to prevent large scale competitive production from springing up in new areas. They also learned that too high prices would lead to increased use of substitutes, reducing their markets and arousing serious international criticism. The income from rubber, however, had contributed vitally to the economies not only of the producing countries, but also the financial strength and economic well-being of the United Kingdom and the Netherlands. When the depression of the early 1930's brought the price of natural rubber to a level under 5 cents U. S. a pound for a period of over two years, and economic planners the world over were taking measures possible in their respective orbits to improve economic conditions, it is not surprising that a new and this time comprehensive international rubber agreement won the adherence of all the rubber producing nations of the Far East with the sponsorship of the British and Dutch Governments, and cooperation of the French Government interested in their Far East possessions. On April 29, 1934, the International Rubber Regulation Agreement was announced as a plan to regulate the plantation rubber industry in the period June 1, 1934 to December 31, 1938; the Agreement was in 1938 extended to December 31, 1943.

The purpose of the scheme was to regulate the production and export of rubber with the object of reducing world stocks to a normal figure (later, keeping stocks at a normal figure) and adjusting supply to demand in an orderly manner, and maintaining a fair and equitable price level reasonably remunerative to efficient producers.

The original agreement established basic quotas for each region for each year from 1934 through 1938, provisions for determining and announcing permissible export percentages by the International Rubber Regulation Committee, with headquarters in London, with the voting strength of members equivalent to the basic quotas of the countries they represented. They sought the cooperation of consumers through an Advisory Panel, on which there were representatives of American, British, and German manufacturers. Under the Agreements the exportation of rubber seeds and seedlings to non-member countries was banned, to prevent competitive new planting outside the restriction area; within that area, the authorized new planting and replanting was strictly limited at first, but later replanting provisions were liberalized enough to permit gradual conversion of low-yield estates to a high-yield

basis. The internal administration of the scheme in each region was the responsibility of the local government, and the record shows that in Malaya and the Netherlands Indies, at least, the local administrations favored the large estates more than the smallholders and natives.

When the Agreement was announced the price of No. 1 Ribbed Smoked Sheet was under 8 cents a pound, and many producers would have been happy to be sure of a future price stabilized at 10 to 12 cents. Slowly, as permissible export percentages were reduced, their price ideas changed to somewhat higher levels, however. Study of the records shows that American manufacturers became strongly resistant to prices above 15 cents a pound, and reduced their purchasing and stocks until, in the early 1937 period of rising demand they became pinched for supplies, with a resulting short-term price rise above 25 cents. Representations from Governments of consuming nations resulted in the grant of larger percentages of permissible exports by the Committee, and the increased supplies of rubber squelched the boom and continued into 1938, when, coupled with the late 1937-38 downturn in consumption, world stocks were growing rapidly and prices declined. Upon this, the Committee reduced the allowable exports to only 45 percent of basic quotas (the all-time low) during the last half of 1938, and to 50 percent for the first half of 1939.

From that time to the Japanese attack on Pearl Harbor, the regulation administration, slowly and reluctantly at first, but at long last desperately and wholeheartedly, turned to a more liberal policy—at a price of 18 1/2 cents per pound—designed to enable the United States to accumulate the strategic stockpile of natural rubber with which we entered the war. After Pearl Harbor the Agreement was influential in only one incident—the export of rubber seeds from Ceylon to areas in Africa where it was desired to establish new plantations was refused. The Agreement was terminated in 1943.

This abbreviated statement concerning rubber restriction schemes of the past may be amplified in detail by consulting Knorr's "World Rubber and Its Regulation," mentioned in the Appendix. This review would be incomplete without some mention of recent international discussions.

Post-War Situation and Discussions

The development of synthetic rubber in the United States during World War II has since the war placed the balance of power in the international rubber situation at least temporarily in the United States. Out of hard experience in the past, members of our rubber manufacturing industry are suspicious of and opposed to international rubber regulation schemes, and they are on record in favor of low prices for rubber, both natural and synthetic.

The Rubber Study Group was initiated in 1944 with a concept that, if the synthetic rubber factories were kept in full production, and plantations in the Far East also restored to full production, there would surely be a surplus of rubber. Broadly speaking, however, there has been no serious over-production of rubber since the war, principally because of actions taken by the United States Government. On the one hand, we have purchased a huge tonnage of natural rubber and set it aside in our strategic stockpile; on the other hand we have so administered our control of rubber consumption as to permit the consumption of all the natural rubber, by and large, that was available for the use of our manufacturers, and we have produced enough synthetic rubber merely to satisfy the residual demands of the consuming industries.

In 1950-51, we even failed to provide as much synthetic as was needed in a period of abnormal demand, while at the same time we engaged in aggressive stockpiling of natural rubber. The high price of natural rubber that resulted is chargeable to American industry and Government shortsightedness and to a combination of abnormal international circumstances, and not to exploitation.

XIII

Bibliography

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Bibliography

The following list is highly selective. It is intended to represent the published material that it would be desirable to read or consult frequently in order to be reasonably well informed on rubber economics and current industry and trade developments.

The best general book on rubber is "World Rubber and Its Regulation," by K. E. Knorr, Stanford University Press, (1945). This will provide an excellent objective picture of principal rubber events since 1920, with an international slant.

An indispensable statistical reference for natural, synthetic and reclaimed rubber is the Rubber Statistical Bulletin published monthly by the Secretariat of the International Rubber Study Group. Contains available information for all countries of the world. Each issue contains annual statistics for ten years. A copy for a single month for each back year to July 1946, plus the issues for the current year, make a complete set.

The United States production, imports, consumption, exports and month-end stocks of rubber (natural, synthetic by types, and reclaim) are published by the NPA Rubber Division, in a monthly statistical statement. Each issue contains annual statistics for ten years.

The following special reports and legislation of the United States Government should be kept at hand for reference:

(1) Report of the Rubber Survey Committee (Baruch, Compton, Conant) recommending our rubber program for World War II. Issued September 10, 1942.

(2) Reports (1st and 2nd in one pamphlet) of the Interagency Policy Committee on Rubber (Wm. Batt, Chairman) with recommendations for our post-war rubber policy. Issued July 22, 1946.

(3) The Rubber Act of 1948 (Public Law 469, 80th Congress). The national rubber policy declared in this legislation is basic.

(4) The Stockpiling Act (Public Law 520, 79th Congress) containing the authority for strategic stockpiling of rubber among other vital and strategic materials.

(5) Synthetic Rubber—Recommendations of the President to Congress, with a report on maintenance of the synthetic rubber industry in the United States and disposal of Government-owned synthetic rubber facilities. Issued January 1950.

(6) First (dated July 1949), Second (dated February 1951), and Third (dated September 1951) Annual Reports by the Secretary of Commerce on Rubber, summarizing the administration of our post-war rubber controls under Public Law 24 and the Rubber Act from April 1, 1947 through June 30, 1951.

(7) The Defense Production Act of 1950 (Public Law 774, 81st Congress) extending the Executive authority over all industries beyond the limits established for rubber in the Rubber Act of 1948.

(8) First, Second, and Twenty-ninth Reports of the Preparedness Subcommittee of the Senate Committee on Armed Services, with criticism and recommendations relative to our national preparedness from a rubber standpoint.

(9) The "Rubber Red Book." A complete directory of domestic rubber manufacturers, traders, reclaimers, and suppliers of machinery, chemicals and fabrics used in rubber manufacturing. The manufacturers are listed alphabetically with descriptive information on products and locations of plants in this country.

(10) "Reclaimed Rubber"—John M. Ball, (1947). Rubber Reclaimers Association.

(11) The two leading domestic rubber trade periodicals are, alphabetically, the India Rubber World and The Rubber Age. These monthlies are valuable for information on current events and technical developments, and on current prices of rubber and materials used in manufacturing rubber products.

(12) Memmler's "Science of Rubber" is the best technical reference book on rubber. In addition, this publication (American edition, Dunbrook and Morris, 1934) contains a comprehensive bibliography of material published on rubber up to its publication.

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